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Integrated Waste Feed Delivery Plan

Volume 3 – Project Plan

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Abstract: The Integrated Waste Feed Delivery Plan (IWFDP) describes how waste feed will be delivered to the Waste Treatment and Immobilization Plant (WTP) to safely and efficiently accomplish the River Protection Project (RPP) mission. The IWFDP is integrated with the Baseline Case operating scenario documented in ORP-11242 (Rev. 6), *River Protection Project System Plan*. **Volume 1 – Process Strategy** (RPP-40149-VOL1) provides an overview of waste feed delivery (WFD) and describes how the WFD system will be used to prepare and deliver feed to the WTP based on the equipment configuration and functional capabilities of the WFD system. **Volume 2 – Campaign Plan** (RPP-40149-VOL2) describes the plans for the first eight campaigns for delivery to the WTP, evaluates projected feed for systematic issues, projects 242-A Evaporator campaigns, and evaluates double-shell tank (DST) space and availability of contingency feed. **Volume 3 – Project Plan** (RPP-40149-VOL3) identifies the scope and timing of the DST and infrastructure upgrade projects necessary to feed the WTP, and coordinates over 30 projectized projects and operational activities that comprise the needed WFD upgrades. Issues or project-specific risks, potential mitigating actions, and future refinements are also identified in each volume of the IWFDP.

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RPP-40149-VOL3, Rev. 2

Integrated Waste Feed Delivery Plan

Volume 3 – Project Plan

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Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

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Tank Operations Contractor **RECORD OF REVISION**		(1) Document Number: RPP-40149-VOL3, Rev. 2	
(2) Title Integrated Waste Feed Delivery Plan, Volume 3 – Project Plan			
Change Control Record			
(3) Revision	(4) Description of Change – Replace, Add, and Delete Pages	Authorized for Release (5) Resp. Engr. (print/sign/date)	(6) Resp. Mgr. (print/sign/date)
0	Initial release.	R. A. Sexton July 2009	R. D. Greenwell July 2009
1	Revisions were made to fully align with the System Plan (ORP-11242 Rev. 5). Incorporation of expanded baseline scope and schedule refinement. Updated risk register. Appendices C, K, L, M, and O have been cancelled for Revision 1 but are reserved for future revisions. The Sludge Staging Plan and Summary of Cost Estimates are brief and have been included in the main body of the document in Sections 5.4.3 and 8.3 respectively. To maintain continuity and to allow for future updates, Appendices F and H have been maintained in the lettered list of Appendices.	P. G. Haigh November 2010	D. C. Larsen November 2010
1A	Editorial changes, Figure 2-1 was reinserted, pagination correction for Appendix N and page number alignment.	P. G. Haigh December 2010	D. C. Larsen December 2010
2 RS	Complete rewrite. Split RPP-40149 into three volumes, addressing waste feed delivery process strategy (Volume 1), campaign plan (Volume 2), and project plan (Volume 3). Content was aligned with the System Plan (ORP-11242, Rev. 6) Baseline Case operating scenario, the process strategy in Volume 1, and the campaign plan in Volume 2. Incorporated expanded baseline scope and schedule refinement. Updated the risk register.	J. S. Rodriguez 03/19/12	J. W. Kelly 03/19/12 J W Kelly

EXECUTIVE SUMMARY

To achieve the U.S. Department of Energy (DOE), Office of River Protection (ORP) mission, optimized and reliable feed of retrieved wastes must be provided from the Hanford tank farms to the Waste Treatment and Immobilization Plant (WTP) and potential new treatment facilities that may be operated in the future. The Tank Operations Contract (TOC),[1] contract line item number 3 (CLIN 3), "WTP Support," includes the workscope to perform project planning, system upgrades/replacements, and operations to accomplish waste feed delivery (WFD) to the treatment facilities.

To accomplish WFD and comply with TOC requirements, an Integrated Waste Feed Delivery Plan (IWFDP) was developed. The IWFDP is divided into three volumes: Volume 1 – Process Strategy (RPP-40149-VOL1),[2] Volume 2 – Campaign Plan (RPP-40149-VOL2),[3] and Volume 3 – Project Plan (this document). Figure ES-1 provides the scope and summary for each volume of the IWFDP (see Figure 2-1 for a complete project process flow diagram.)

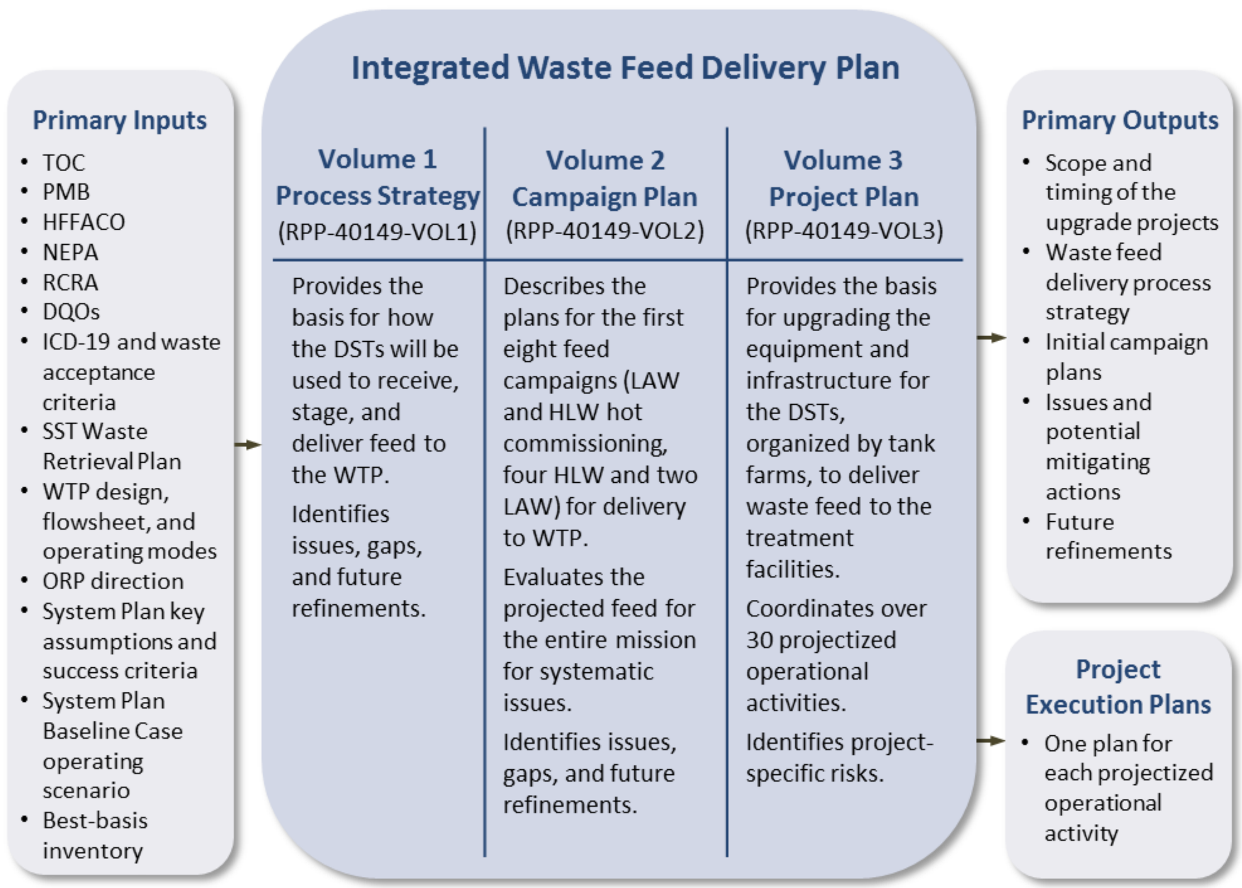

Figure ES-1. Scope and Purpose of the Integrated Waste Feed Delivery Plan

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[1] DE-AC27-08RV14800, *Tank Operations Contract*, U.S. Department of Energy, Office of River Protection, Richland, Washington.

[2] RPP-40149-VOL1, 2012, *Integrated Waste Feed Delivery Plan, Volume 1 – Process Strategy*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

[3] RPP-40149-VOL2, 2012, *Integrated Waste Feed Delivery Plan, Volume 2 – Campaign Plan*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

IWFDP Volume 1 (Process Strategy) provides the basis for how the double-shell tanks (DST) will be used to stage and deliver waste feed to the WTP. This volume provides an overview of WFD topics, describes the WFD system utilization based on the capabilities of the DST system configuration, and presents the WFD process strategy.

IWFDP Volume 2 (Campaign Plans) describes the detailed plans for the first eight campaigns—low-activity waste (LAW) and high-level waste (HLW) hot commissioning, plus four HLW and two LAW campaigns—delivered to the WTP and evaluates the projected feed delivered throughout the River Protection Project (RPP) mission for systematic issues. The campaign plan is based on the Baseline Case operating scenario documented in ORP-11242, *River Protection Project System Plan* (Rev. 6).[4]

IWFDP Volume 3 (Project Plan), presented in this document, establishes the basis for the integrated waste feed delivery (IWFD) system architecture, including DST equipment, waste transfer systems, and supporting infrastructure and utilities. Equipment and infrastructure upgrades are coordinated through more than 30 projectized operational activities (IWFD projects). The project plan also identifies the project execution plans for each of the operational activities.

The primary objective of this project plan is to establish required modifications to existing systems and installations of new systems to meet WTP startup and processing needs associated with WFD. The assumptions for WFD planning, including WTP schedule needs, are consistent with the System Plan (Rev. 6). Tank farms WFD upgrades activities support WTP hot commissioning starting in May 2018, with full operation beginning in December 2019.

Additional objectives of the project plan include:

- Assessing safety risks and opportunities on a continuous basis
- Optimizing cost efficiency
- Relying on mature/proven technology
- Integrating upgrades with other tank farms work
- Placing a high priority on operability and maintainability of systems
- Assessing and responding to project performance risks
- Providing flexibility to adapt to evolving requirements and process improvement opportunities.

Modifications and new tank farms hardware systems will provide comprehensive upgrades to the DST farms waste retrieval, mixing, characterization, and transfer systems, and supporting infrastructure. This work includes planning and executing projects over the life of the RPP mission. Decisions on waste retrieval strategies and waste preparation needs, including pretreatment or blending, will be made during the execution of the TOC. The selection and configuration of treatment, storage, and disposal facilities to disposition the waste will also impact WFD requirements.

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[4] ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U.S. Department of Energy, Office of River Protection, Richland, Washington.

The capability to operate these systems will be developed concurrently with the IWFD projects, including training personnel, commissioning waste feed systems and demonstrating readiness, and operating feed systems to meet treatment facility needs. Finally, close integration will be needed externally with the WTP and other Hanford Site contractors, and internally with the tank farms Base Operations and Single-Shell Tank (SST) Retrieval organizations.

An integrated systems approach was taken to establish a step-by-step hardware baseline by evaluating existing DST farm conditions and the status of site infrastructure and storage/retrieval systems, completing an update of system functions and requirements, and holding value engineering workshops to discuss lessons learned. Potential innovations from historical operations in the Hanford tank farms and at the Savannah River Site (SRS) were gleaned from this process.

An SRS site visit was conducted in 2009 to better understand the mixer and transfer pumps used at SRS. The SRS operations experience identified the successful use of submersible mixer pumps for the initial mobilization and suspension of settled sludges in the tanks. These suspended solids were then transferred into dedicated mixing/feed tanks that use continuous mixing via long-shafted mixer pumps to maintain homogeneous mixing of the waste prior to final transfer to the vitrification plant. Lessons learned from SRS experience are incorporated into the Hanford planning.

More than 30 IWFD projects—possible Category 2[5] engineering, procurement, construction, and commissioning projects, organized by tank farm—are identified to construct and commission the systems required for delivering feed from the 28 DSTs to the WTP. The workscope, execution approach, schedule, and cost estimates for each IWFD project are described in this volume of the IWFDP. Consistent with the ongoing approach for implementing SST retrieval projects, these projects have been identified as a series of discrete projects. Because of the duration and magnitude of the WFD and DST upgrades, a series of smaller projects are considered more manageable and will allow closure of specific projects as they are completed.

[5] Category 2 is defined in TFC-PRJ-PM-C-03, *Project Categorization and Tailoring*, as "Expense-funded activities (medium complex to complex) consisting of relatively long duration (months to years) work, which require a focused amount of planning and coordination between multiple organizations to develop performance baselines and accomplish project objectives and goals. These activities generally involve relatively minor impacts on the facility safety basis. They can require design and construction, and a system startup. This category may require a management self-assessment/readiness assessment to begin operations and are traditional design/build projects which are no longer considered capital assets."

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APPENDICES

FIGURES

TABLES

TERMS

Abbreviations and Acronyms

ARRA	American Recovery and Reinvestment Act
ASME	American Society of Mechanical Engineers
BCWS	budgeted cost for work scheduled
CAM	control account manager
CD	critical decision
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHAMPS	computerized history and maintenance planning software
CLIN	contract line item number
CR	certification requirement
DOE	U.S. Department of Energy
DQO	data quality objective
DST	double-shell tank
Ecology	Washington State Department of Ecology
EIN	equipment identification number
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPCC	engineering, procurement, construction, and commissioning
ESH&Q	environment, safety, health, and quality
FY	fiscal year
HAMTC	Hanford Atomic Metal Trades Council
HANDI	Hanford data integrator
HLW	high-level waste
HPIC	HANDI PERF IPARS control
HTWOS	Hanford tank waste operations simulator
ICD	interface control document
IDMS	integrated document management system
IHLW	immobilized high-level waste
ILAW	immobilized low-activity waste
IPARS	integrated planning and reporting system
IPT	integrated project team
ISMS	integrated safety management system
ITAAC	inspection, testing, analysis, and acceptance criteria
IWFD	integrated waste feed delivery
IWFDP	Integrated Waste Feed Delivery Plan
JMN	justification of mission need
LAW	low-activity waste
LLW	low-level waste
MLLW	mixed low-level waste
MSA	Mission Support Alliance
NEPA	National Environmental Policy Act
NOC	notice of construction
O&M	operations and maintenance

OR	operations research
ORP	U.S. Department of Energy, Office of River Protection
ORR	operational readiness review
PCB	Polychlorinated biphenyl
PEP	project execution plan
PERF	performance module
PMB	performance measurement baseline
QA	quality assurance
QAIP	quality assurance inspection plan
QAPD	quality assurance program description
RAMI	reliability, availability, maintainability, and inspectability
RCRA	Resource Conservation and Recovery Act
RPP	River Protection Project
SEPA	State Environmental Policy Act
SSC	structures, systems, and components
SST	single-shell tank
TC & WM	Tank Closure and Waste Management
TOC	Tank Operations Contract
TPA	Tri-Party Agreement
TRL	technology readiness level
TRU	transuranic
WAC	Washington Administrative Code
WBS	work breakdown structure
WDOH	Washington State Department of Health
WFD	waste feed delivery
WIPP	Waste Isolation Pilot Plant
WRF	waste retrieval facility
WRPS	Washington River Protection Solutions, LLC
WTP	Waste Treatment and Immobilization Plant

Units

°F	degrees Fahrenheit
acfm	actual cubic feet per minute
Ci	curies
ft	feet
gal	gallon
hp	horsepower
hr	hour
Hz	hertz
in.	inch
kgal	thousand gallons
lb	pound
m	meter
Mgal	million gallons
min	minute
mrem	millirem
MTG	metric tons of glass
Pa	pascal
rpm	revolutions per minute
scfm	standard cubic feet per minute
SpG	specific gravity
vol%	volume percent
wt%	weight percent

1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection (ORP) manages the River Protection Project (RPP) at the Hanford Site. The RPP mission is to retrieve and treat the Hanford tank waste and close the tank farms to protect the Columbia River. As a result, ORP is responsible for the retrieval,[6] treatment, and disposal of approximately 55 Mgal[7] of radioactive waste contained in the Hanford waste tanks and closure of all the tanks and associated facilities. The tank farms must be able to reliably prepare and transfer waste feed to the Waste Treatment and Immobilization Plant (WTP) and other potential new treatment facilities to successfully execute the RPP mission.

Washington River Protection Solutions, LLC (WRPS) was awarded the Tank Operations Contract (TOC),[8] beginning October 1, 2008, for a five-year period, with a possible extension for a total of 10 years. This project plan refers to the "contract period" as the 10 years, from October 2, 2008, to September 30, 2018. TOC contract line item number 3 (CLIN 3), "WTP Support," includes the workscope to perform project planning, system upgrades/replacements, and operations to accomplish waste feed delivery (WFD) to treatment facilities.

The second revision of *the* Integrated Waste Feed Delivery Plan (IWFDP) Volume 3 (Project Plan) presents the progression of the baseline and completion approach for the IWFDP project execution plans (PEP). This volume was adopted from RPP-40149, *Integrated Waste Feed Delivery Plan* (Rev. 1).

This project plan provides the basis for upgrading the equipment and infrastructure for the double-shell tanks (DST), organized by tank farm, to deliver waste feed to the treatment facilities. It coordinates over 30 projectized operational activities (integrated waste feed delivery [IWFD] projects) and identifies project-specific risks. The project plan upgrades are organized into discrete projects identified separately from tank farms life-extension upgrades or facility construction and maintenance conducted for other purposes. Although identified separately for clarity, the execution of WFD workscope is integrated with other planned tank farms activities, such as waste transfers, single-shell tank (SST) retrieval sequencing, and others. Revision 6 of ORP-11242, *River Protection Project System Plan* (referred to hereafter as System Plan), provides the WFD schedule that serves as a foundation for the technical scope and timing of the work described in this project plan. Section 1.4 of IWFDP Volume 1 describes how each volume of the IWFDP relates to the upper-level documents. The relationship of this project plan to the System Plan (Rev. 6) is discussed further in Section 4.2.1.

The current schedule and scope for this project plan are reflected in Section 7.5.1, Figure 7-3.

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[6] Selected words in the Glossary (Appendix A) appear in this document as blue underlined text, and are hyperlinked to the corresponding definitions in the glossary.

[7] This is the total volume of tank waste as of October 2010 from HNF-EP-0182, *Waste Tank Summary Report for Month Ending September 30, 2010* (Rev. 270). The total volume of tank waste fluctuates over time because water and chemicals may be added to the tanks as part of certain waste retrieval processes to facilitate waste retrieval; water is also removed by the waste evaporator.

[8] DE-AC27-08RV14800, 2008, *Tank Operations Contract*, U.S. Department of Energy, Office of River Protection, Richland, Washington

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2.0 PURPOSE AND SCOPE

The purpose and scope of this project plan are described in Sections 2.1 and 2.2, and include an updated Justification of Mission Need (JMN).

2.1 PROJECT CHARTER

TOC Section C.2.3.1, "Treatment Planning, Waste Feed Delivery, and WTP Transition," defines the workscope for WFD, including project planning, tank farms upgrades and new equipment installations, and operations to accomplish pretreatment, blending, mixing, retrieving, and transferring tank waste to support optimized and reliable feed delivery to the waste treatment facilities.

2.1.1 Justification of Mission Need Background

The WFD preparations began in the early 1990s under Project W-211, and have continued under various projects that are described in more detail in Section 3.0. Project W-211 was originally chartered with providing systems for the retrieval of wastes from ten DSTs and a transfer system from AP Farm to an interface point with the WTP. The JMN was approved as a component of the conceptual design critical decision package (CD-0). WRPS revalidated CD-0 as part of the due diligence process during the transition of the TOC (Armstead 2008). The revalidation reaffirmed the mission need for DST retrieval systems and infrastructure upgrades to support WFD to the WTP, and concluded the following.

- Waste retrieval from all 28 DSTs will be required to support WTP.
- The DSTs will require upgrades to support waste retrieval and delivery. A list of expected upgrades is provided in the revalidation letter report. However, functions and requirements for each tank and tank farm will be updated consistent with ongoing planning and modeling.
- The use of mixing pumps to mobilize tank waste has been demonstrated. Existing design work provides a basis for initiating design for a mixer-pump retrieval system for any DST. (Note that the ability of mixing pumps to provide waste feed consistency that will meet WTP acceptance requirements has yet to be demonstrated. Preliminary project work on small-scale mixing and remote sampler demonstration test platforms has been initiated as a contingency. Mixing and sampling issues are discussed in Section 16.0).[9]

2.1.2 Justification of Mission Need Update

Following the CD-0 revalidation, WRPS assigned the WTP WFD Projects Team to develop IWFD system inputs to the Hanford tank waste operations simulator (HTWOS) model and support model iterations to formulate the technical basis for System Plan (Rev. 6). The project plan further defines the workscope and execution strategy, the current state of DST farms and supporting infrastructure, and updates requirements and WFD needs. Table 2-1 compares key elements of the WRPS revalidation letter report with current understanding.

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[9] Changes in the TOC baseline have taken place since the Armstead (2008) letter was issued and the purpose-built mixing/sampling facility is not in the current baseline and is not being pursued.

Table 2-1. Justification of Mission Need Update

Topic	Update Description	Status
Element	WRPS revalidation letter report[a]	Current plan
Alignment	The DST system will be used to receive new waste generated by miscellaneous Hanford Site facilities and waste retrieved from the SSTs, and to stage waste for delivery to pretreatment and treatment facilities.	No change
Capability gap	Retrieval of waste to support WTP will be required from all 28 DSTs.	No change
Approach	DST upgrades will take advantage of previous project work, while addressing current and future planning and known issues.	No change
Resource and schedule forecast	Summarized based on WRPS proposal.	Updated in accordance with current PMB
Conclusions	Summarized in Section 2.1.1	No change

[a] Armstead, M., 2008, "Contract Number DE-AC27-08RV14800 – Washington River Projection Solutions LLC Double-Shell Tanks Upgrades Revalidation of CD-0," (Letter 29633-000076-BUS-LT to J. Poniatowski, U.S. Department of Energy, Office of River Protection, September), Washington River Protection Solutions, LLC, Richland, Washington.

DST = double-shell tank.
PMB = performance measurement baseline.
SST = single-shell tank.
WRPS = Washington River Protection Solutions, LLC.
WTP = Waste Treatment and Immobilization Plant.

2.1.3 Technical Objectives

The primary objective of WFD and DST upgrades is to ensure that the Hanford tank farms are able to provide *optimized*, *continuous*, and *reliable* feed to the WTP or new supplemental treatment systems. WFD objectives will be further defined as additional modeling and planning are completed and refined, needed technologies are matured, and the definition of tank waste treatment requirements evolves. The technical objectives are designed to provide flexibility to adapt as knowledge is gained, while supporting the ultimate mission of tank waste treatment and disposal. For purposes of this project plan, the following definitions are used:

- **Optimized –** Implements the pretreatment blending, mixing, retrieval, and transfer performance criteria determined by updated system planning.
- **Continuous –** Achieves the schedule and rates for feed delivery to the WTP or new supplemental treatment systems. These requirements are defined in interface control documents (ICD) approved by ORP (24590-WTP-ICD-MG-01-019, *ICD 19 – Interface Control Document for Waste Feed* [ICD-19]) and in the System Plan (Rev. 6), which states:
  - The WTP Pretreatment Facility shall have the capability to receive and store 1,500 kgal (5,680 m^3) of low-activity waste (LAW) feed. The design shall include the capability to receive without interruption 1,125 kgal (4,260 m^3) of LAW feed, while processing from the remaining capacity of 375 kgal (1,420 m^3) of LAW feed. The tanks shall be connected to allow blending. DOE will determine the size of each batch transferred. The Tank Operations Contractor plans to transfer batches to fill the WTP Contractor's feed receipt vessels in optimum practical quantities to meet the amount of waste feed requested by the WTP Contractor.

  - After hot commissioning, the WTP High-Level Waste (HLW) Facility will ramp up its vitrification capacity to produce 4.2 metric tons of glass (MTG) per day with a design capacity of 6.0 MTG per day and 5.25 MTG/day with a design capacity of 7.5 MTG/day (upgraded melters). The WTP Pretreatment Facility will be capable of receiving up to 145 kgal (548.89 m^3) of HLW feed per batch followed by transfer line flush solution from the tank farms to the WTP.
- **Reliable –** Evaluates and responds to WFD performance risks to achieve an estimated 80 percent or greater probability of achieving optimized, continuous waste feed.

The overall RPP process flow diagram is provided in Figure 2-1.

2.1.4 Schedule Objectives

The overall schedule objective is to complete WFD upgrades in time to support hot commissioning and continuous treatment operations of the WTP or new supplemental treatment systems. The enabling assumptions of System Plan (Rev. 6) state that the WTP will initiate hot commissioning in May 2018, and full operations in December 2019.

2.1.5 Cost Objectives

The cost objective of this project plan is to perform the design, construction, and commissioning workscope during the near-term baseline in 2013 and contract extension through 2018. These costs include necessary upgrades of existing systems, equipment removals to prepare for IWFD equipment and supporting infrastructure installations, technology maturation, and deployment and project support. Life-extension upgrades or upgrades by others that will be integrated with WFD planning and support WFD objectives, or upgrades that are planned beyond the TOC 10-year contract period, are not included. Detailed scope, cost profile, and schedule data can be found in the figures provided in Sections 6.0 and 7.0.

2.1.6 Project Description

The WFD upgrades consist of a series of projects to enable the existing DST farms to retrieve, prepare, certify, and transfer tank wastes to the WTP. Over 30 possible Category 2[10] engineering, procurement, construction, and commissioning (EPCC) projects organized by tank farm are planned to construct and commission the feed systems required for the RPP mission. These projects are identified as a series of discrete projects, which summarized in Section 7.6, Figure 7-3. Because of the duration and magnitude of the WFD and DST upgrades, a series of smaller projects is considered more manageable and will allow closure of specific projects as they are completed.

Figure 2-2 provides an overview of the completed WFD system.

[10] Category 2 is defined in TFC-PRJ-PM-C-03, *Project Categorization and Tailoring*, as "Expense-funded activities (medium complex to complex) consisting of relatively long duration (months to years) work, which require a focused amount of planning and coordination between multiple organizations to develop performance baselines and accomplish project objectives and goals. These activities generally involve relatively minor impacts on facility safety basis. They can require design and construction, and a system startup. This category may require a management self-assessment/readiness assessment to begin operations and are traditional design/build projects which are no longer considered capital assets."

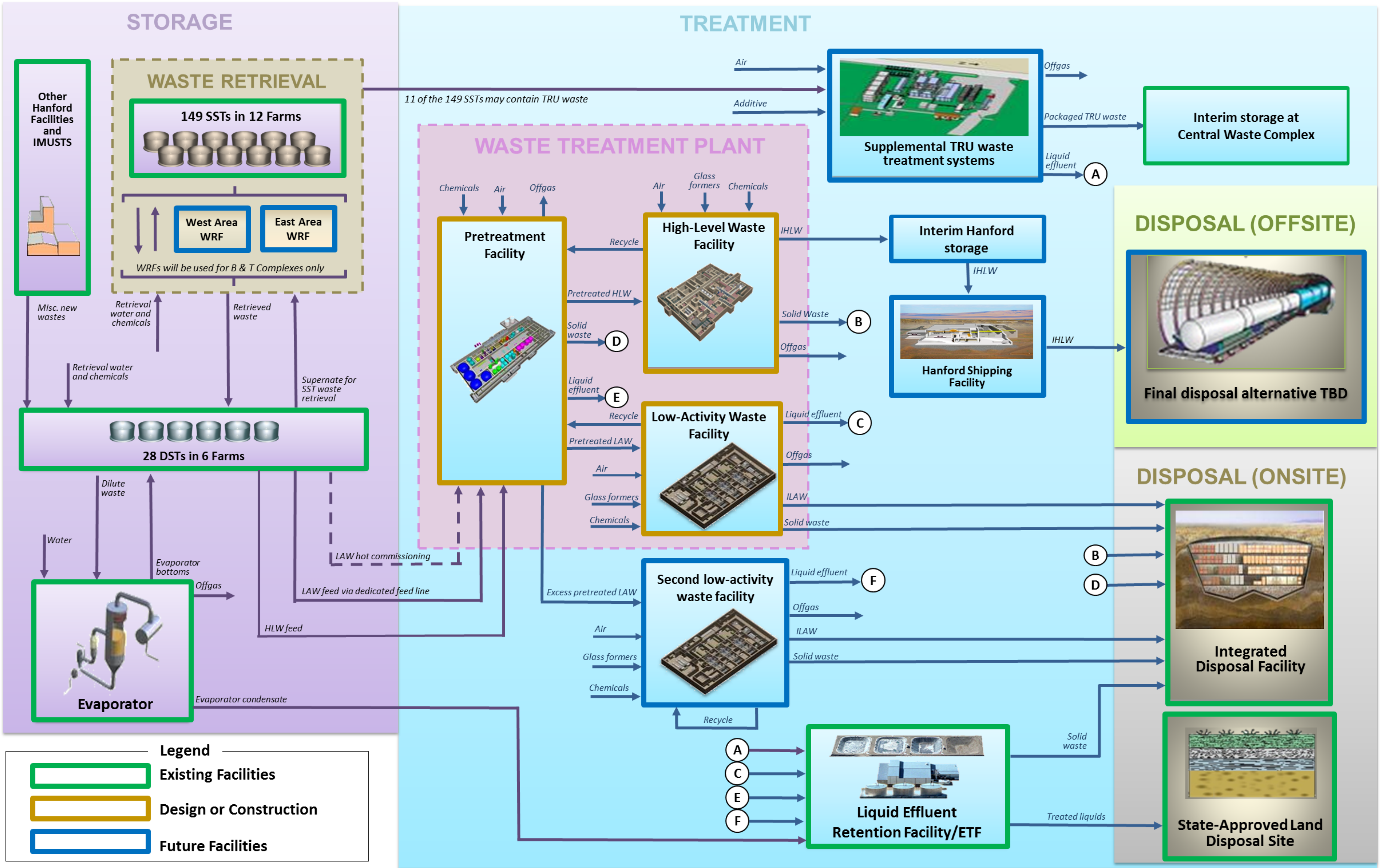

Figure 2-1. River Protection Project Simplified Process Flow Diagram

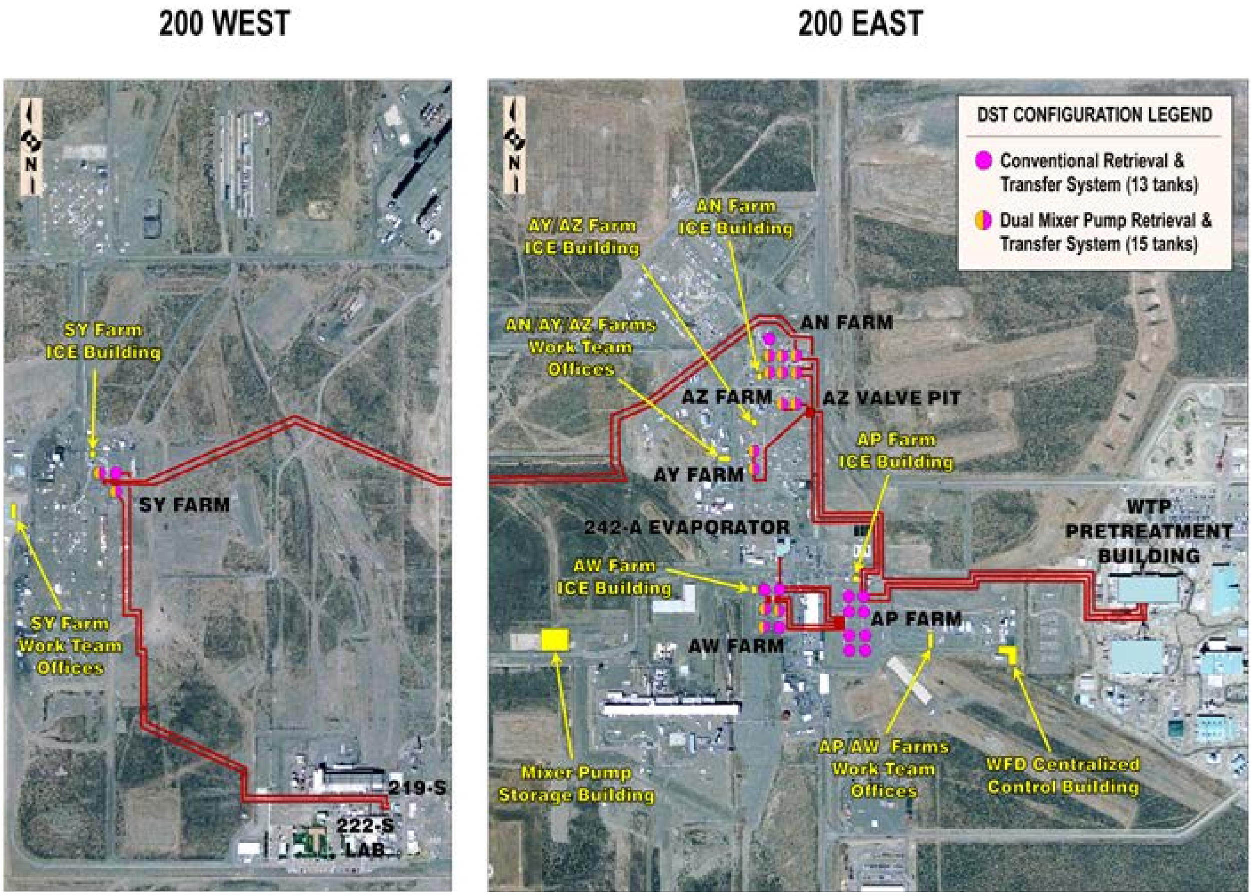

Figure 2-2. Waste Feed Delivery System Overview

The IWFD system will include the following:

- Fifteen DSTs that are outfitted for retrieval, receipt, and transfer of sludge waste; these DSTs may also support tank waste pretreatment and blending in preparation for transfer to downstream treatment facilities
- 13 DSTs that are outfitted for retrieval, receipt, and transfer of dissolved salt and supernate
- Mixing and sampling equipment to prepare received tank waste for certification and transfer to the WTP
- Transfer lines to move tank waste between DSTs and tank farms, and to treatment facilities
- Infrastructure and controls that support WFD systems.

The WFD capability will be needed throughout the 40-year operational life of the WTP and will include life-cycle system maintenance and equipment replacements. In the event that one or more supplemental treatment systems are selected in addition to the WTP, specific performance criteria for these systems will be established through future revisions of the System Plan and WFD planning.

2.2 PURPOSE OF THE INTEGRATED WASTE FEED DELIVERY PROJECT PLAN

The purpose of this project plan is to establish the basis for the IWFD system architecture, including DST equipment, waste transfer systems, and supporting infrastructure and utilities. Equipment and infrastructure upgrades are coordinated through more than 30 projectized operational activities (IWFD projects). The project plan also identifies the project execution and approach for each of the operational activities, including project management, design, procurement, construction, commissioning, and operations. The project plan focuses on the workscope for the 10-year TOC period, and also establishes the strategy that forms the basis of life-cycle project planning.

The project plan serves as the overall planning document for the workscope defined as IWFD projects. The plan also addresses the pre-CD-1 deliverables required by TFC-PRJ-PM-C-02, *Project Management*, using a graded approach commensurate with a strategic planning document. The Project Navigator database (Project Roadmap)—found on the WRPS intranet home page (http://toc.rl.gov/rapidweb/wrps)—provides an implementation matrix for the WRPS project management requirements.

This project plan will be updated as needed through the life-cycle of the IWFD projects to reflect changes in baseline planning.

3.0 BACKGROUND

Several major tank farms projects executed in the past 20 years have directly influenced the capability of the DST system to provide waste feed to the WTP. These projects, as an example, include the following:

- Project W-058, Cross-Site Transfer System Upgrades
- Project W-151, Tank 101-AZ Waste Retrieval System
- Project W-211, Initial Tank Retrieval Systems
- Project W-314, Tank Farm Restoration and Safe Operations
- Project W-521, Waste Feed Delivery Systems
- Project E-525, DST Transfer System Modifications Project
- Project W-566, SY Transfer Line Upgrade (Recovery Act funded).

Many of these projects provided DST system hardware that was installed, tested, and turned over for operations. This hardware, which is now part of the DST system, was considered and evaluated in the DST system condition assessment discussed in Section 4.1. Other projects produced designs at various stages of completion (e.g., conceptual design complete, Title II design complete) and have been or are being reevaluated for IWFD project use. Reevaluation of the existing DST system compares the existing designs against the current requirements set for feeding waste from the DST system to the WTP.

3.1 HISTORY OF WASTE FEED DELIVERY PREPARATIONS

Some of the projects listed in Section 3.0 were intended to upgrade the DSTs to provide feed to the WTP. Examples of these projects are:

- W-151, Tank 101-AZ Waste Retrieval System
- W-211, Initial Tank Retrieval Systems
- W-314, Tank Farm Restoration and Safe Operations
- W-566, SY Transfer Line Upgrade.

Other projects have provided a combination of DST system hardware and/or design media necessary for life extension and to provide waste feed to the WTP. Examples include the following:

- Primary DST ventilation systems installed in AN and AW Farms by Project W-314

- Cross-site transfer system piping that allows compliant transfers of waste from the 200 West Area to 200 East Area DSTs by Project W-058

- The W-566 project was completed in fiscal year (FY) 2011 as part of the *American Recovery and Reinvestment Act of 2009* (ARRA) workscope. The project included isolation of three cleanout boxes (Figure 3-1), installation of a condensate line (Figure 3-2), and installation of a jumper to allow condensate recycle (Figure 3-3).

Figure 3-1. Excavated and Capped Cleanout Box

Figure 3-2. 241-AZ Condensate Line

Figure 3-3. AZ-02A Jumper

Eight SY Farm transfer lines were removed, four previously fabricated lines were refurbished, and four new transfer lines were fabricated. The project core drilled five of the SY pits and installed new nozzles, which connected the eight transfer lines to the pits in the SY Farm. Figure 3-4 shows excavation activities, tie-in of the transfer lines to the pit nozzles, and form work where controlled density fill will be placed to support the lines prior to backfill.

Figure 3-4. SY Farm Removal and Installation of Transfer Line Piping

All of these projects are related to the starting point for IWFD projects. Table B-1 in Appendix B provides a summary of the intended scope of each of these projects and the scope completed.

3.2 STUDIES RELEVANT TO THE WASTE FEED DELIVERY PROJECTS

Studies that provide relevant background information about applicable WFD DST system designs and their bases are listed in Table C-1 in Appendix C. These documents contain the following:

- Design media that represents the latest generation of equipment design for the IWFD projects evaluation/utilization
- Technical basis information on WFD DST system/equipment design
- Technical basis information on the WFD DST system configuration

- Recommendations on improvements to existing designs that should be revisited at the start of IWFD projects
- Historical information useful to starting IWFD projects (included in Table C-1).

Documents pertaining to the existing DST system configuration and status are addressed in Section 4.0.

Other documents generated by previous WFD/DST upgrades projects (e.g., calculations for specific equipment/farms, previous engineering studies, etc.) are part of the Hanford document management and control system and are too numerous to include in Table C-1. These documents are available via the Hanford document control system with simple searches. Documents that have the potential for inclusion in the current WFD baseline will be evaluated as part of the conceptual/preliminary design phase for each individual IWFD project. A list of legacy documents providing technical basis information will be included in the individual PEPs for the specific projects.

4.0 SYSTEM CONDITIONS AND REQUIREMENTS

Currently, the DST system operates in a manner to ensure (1) safe and compliant storage of existing DST wastes, (2) safe and compliant receipt and storage of wastes from external sources (e.g., 222-S Laboratory, SST retrieval), and (3) safe and compliant waste feed to and receipt of waste from the 242-A Evaporator. The DST system currently satisfies a requirements baseline that includes the approved tank farms safety basis to ensure safe DST system operations. The DST system hardware and operations reside in both the 200 West and 200 East Areas on the Central Plateau of the Hanford Site. The DST system includes the cross-site transfer system and the AN, AP, AW, AY/AZ, and SY Farms.

A brief description of each DST farm, a summary of the DST farm condition assessment, and the detailed condition assessment tables are provided in RPP-40149 (Rev. 0), Appendix K. The ARRA workscope was completed in FY 2011. Updated DST farm condition assessments will be included in future revisions of this project plan.

4.1 DOUBLE-SHELL TANK SYSTEMS CONDITION ASSESSMENT FOR WASTE FEED DELIVERY

The DST systems condition assessment was performed to document the current functionality, operational capabilities, and capacities of structures, systems, and components (SSC) of the DST system. This assessment builds on and updates previous DST assessments. The assessment was performed on all the DST farms. The SSCs within each farm were organized by tank farms system identifier consistent with H-14-020000, "Tank Farms System P&ID Structure Legend." The detailed results of this assessment are documented in the assessment tables contained in RPP-40149 (Rev. 0), Appendix K. Note that this assessment is a result of a comprehensive review of relevant documents (e.g., system design descriptions, system health reports, etc.), field walk-downs, and interviews with system engineers and operations and maintenance (O&M) personnel.[11]

The following are key findings from the DST farm-specific condition assessments performed in support of this revision of the project plan.

- Existing transfer pumps do not provide the required capabilities for delivering feed to the WTP. In some cases, existing transfer pumps may be adequate for inter- and intra-farm transfers. However, DST system transfer pumps will be beyond their design life at WTP startup.
- In general, neither the DSTs nor the tank farms infrastructure are adequate to support mixer pump operation for WFD. The DSTs themselves lack structural support for mounting mixer pumps while the tank farms infrastructure requires plumbing water and power to the mixer pumps.

[11] The condition assessment recognized that field walkdowns and interviews with system engineers and O&M personnel were required to understand the DST farms configuration.

- Some WFD equipment supporting AN and AY/AZ Farms were installed by previous projects (e.g., W-211) and turned over, but are not yet operable. This equipment was turned over to the Base Operations organization for "maintenance only" via the operational acceptance checklist process and is therefore part of the DST system. Engineering holds are placed on the operation of this equipment until operational acceptance testing is complete. The suitability of this equipment for use in satisfying current WFD requirements will be evaluated early in the WFD design process for these tank farms.
- Some of the equipment that is broken, no longer active or in use, has been abandoned in-place and will hinder WFD O&M activities. Such equipment may be removed prior to planned WFD activities.
- Existing in-tank equipment (e.g., slurry distributors, airlift circulators in the AY and AZ Farm tanks, multifunction instrument trees, and corrosion probes) will limit tank waste mixing if left as-is.
- Existing DST ventilation systems will require engineering evaluation to determine system adequacy (e.g., airflow, heat removal) during mixer pump operation for feed delivery, waste transfer, and DST waste sampling. The primary tank ventilation systems of several of the farms (e.g., SY Farm) are only adequate for current safe storage of the waste and will require upgrades to support WFD to WTP.
- The cross-site slurry transfer system, which was installed as part of Project W-058, was never authorized for use. An operational readiness review was not completed and the safety basis was never updated to include this system. The system was turned over to Operations for maintenance; however, minimal maintenance has been performed.

4.1.1 Existing Equipment Not Installed

In addition to the DST system equipment already in operation and assessed as described in Section 4.1, other equipment procured and delivered by Projects W-211, W-314, and E-525 is in inventory and has the potential—but may not be acceptable—to support WFD to WTP. The majority of this equipment resides either in the Marshaling Yard north of the 2704HV Building, or in the 2101M Building, both in 200 East Area. Electrical equipment includes instruments, variable frequency drives for mixer pump control, and spare mixer pump motors. A complete listing of this equipment is provided in the Project Equipment Marshaling Yard database, which is managed and maintained by WRPS Project Management Systems. Preventive maintenance of this equipment is funded by the Base Operations organization.

4.1.2 Installed Equipment Not Turned Over for Operations and Maintenance

Due to a change in the forecasted operational need of some of the installed equipment, a portion of the procured Project W-211 equipment has been installed in the tank farms, but has not been turned over for O&M. Table 4-1 lists installed Project W-211 equipment not yet turned over for operations. Installed equipment not turned over for operations from other projects (e.g., W-058) are identified in the DST system condition assessments included in RPP-40149 (Rev. 0), Appendix K.

Table 4-1. Installed W-211 Equipment Not Turned Over for Operations and Maintenance

EIN	Description	Location
Multiple (detailed list to be provided)[a]	Field terminal boxes and enclosures	AN Farm
AN241-RW-PNL-101	Retrieval equipment service water enclosure (includes all equipment inside enclosure)	West of AN Farm
POR34-RW-BLR-101	Portable boiler (includes all equipment mounted on boiler skid).	West of AN Farm
POR34-MS-TK-501	Boiler fuel storage tank	West of AN Farm
N/A	Caustic pump enclosure	West of AN Farm
CHEMB-P-001	Caustic metering pump	Inside caustic pump enclosure
CHEMB-TK-001	Diluent/flush tank (includes associated piping and instruments)	West of AN Farm
CHEMB-P-003	Truck offloading station sump pump	West of AN Farm
N/A	Raw water treatment enclosure (includes all equipment and piping inside enclosure.	West of AN Farm
N/A	Enclosed safety shower/eyewash and associated equipment.	West of AN Farm

[a] Portions of equipment identification number this equipment will be turned over for 241-C-104 retrieval.

EIN = equipment identification number.
N/A = not applicable.

Figure 4-1 shows the diluent and flush system installed by Project W-211, just west of AN Farm, which is not yet turned over for operation. This equipment will be excessed by the AY/AZ Farm infrastructure project.

Figure 4-1. Project W-211 Installed Diluent and Flush System, West of AN Farm

Equipment installed but not turned over for O&M is not the same as equipment that has been installed and turned over for maintenance only. The diluent and flush system is capable of supplying hot, chemically adjusted water to the transfer system for in-line dilution of waste with a high specific gravity (SpG), as necessary. It is also capable of flushing the transfer system after a waste transfer. Equipment installed and turned over (and accepted) for maintenance only was done via the operational acceptance checklist process. Because this equipment has been turned over and accepted, it is captured in the drawing set reviewed in the condition assessment described in Section 4.1.1.

4.2 SYSTEM REQUIREMENTS

WRPS develops and maintains the tank farms technical baseline using the engineering processes described in TFC-PLN-03, *Engineering Program Management Plan*. A discussion of the technical baseline development is provided in Section 5.1. The integrated requirements baseline portion of the technical baseline and its relationship to the system requirements applicable to this project plan are discussed herein.

The technical requirements baseline is developed via analyses of requirements levied on the contractor responsible for operating the tank farms through the TOC. Technical requirements analyses translate the contractual requirements in the TOC into system-level and equipment design requirements. These design requirements relate, for example, to system or equipment interface constraints; performance and design features related to safety (nuclear and industrial); environmental protection; operability, reliability, and maintainability; material compatibility; constructability; and standardization and human factors. This translation results in the requirements baseline currently documented in the following DST system and subsystem specifications:

- HNF-SD-WM-TRD-007, *System Specification for the Double-Shell Tank System*
- HNF-4155, *Double-Shell Tank Monitor and Control Subsystem Specification*
- HNF-4157, *Double-Shell Tank Utilities Subsystem Specification*
- HNF-4159, *Double-Shell Tank Maintenance and Recovery Subsystem Specification*
- HNF-4160, *Double-Shell Tank Transfer Valving Subsystem Specification*
- HNF-4161, *Double-Shell Tank Transfer Piping Subsystem Specification*
- HNF-4162, *Double-Shell Tank Transfer Pump Subsystem Specification*
- HNF-4163, *Double-Shell Tank Diluent and Flush Subsystem Specification*
- HNF-4164, *Double-Shell Tank Mixer Pump Subsystem Specification*
- RPP-SPEC-45605, *Double-Shell Tank Ventilation Subsystem Specification*
- RPP-SPEC-47615, *Double-Shell Tank Process Waste Sampling Subsystem Specification.*

This requirements baseline (i.e., the specifications cited in this section) has been and will continue to be evaluated and updated to ensure that it is consistent with the current and future revisions to the Baseline Case operating scenario in the System Plan (Rev. 6), IWFDP Volumes 1 and 2, and any modifications to the requirements in the TOC.

4.2.1 River Protection Project System Plan

The Baseline Case operating scenario evaluated in the System Plan (Rev. 6) and the resulting process strategy and campaign plan in RPP-40149, Volumes 1 and 2, provides the basis for the scope and schedule of the infrastructure upgrades necessary to execute the RPP mission. The following are features and assumptions related to WFD:

- The technical and programmatic assumptions associated with each facility supporting the RPP mission, including their underlying flowsheet, treatment capacities, startup and ramp-up schedules, and feed and product specifications
- The success criteria identified in System Plan (Rev. 6), comprising a selected subset of the *Hanford Federal Facility Agreement and Consent Order – Tri Party Agreement* (TPA) (Ecology et al. 1989) and Consent Decree (2010) milestones, near-term funding targets, and life-cycle cost targets
- The SST retrieval strategy, as defined in RPP-PLAN-40145, *Single-Shell Tank Waste Retrieval Plan*, and associated assumptions
- Constraints on the use of the DSTs, as identified in the IWFDP Volume 1, Section 3.0 and Appendix B. These include limitations due to tank content, solids handling capabilities, flammable gas generation, waste compatibility requirements, sampling capabilities, and waste transfer system capabilities. IWFDP Volume 1, Section 6.0, and Volume 2, Section 9.0, identify possible refinements to the Baseline Case operating scenario in future versions of the System Plan.
- The use of a dedicated transfer route for delivery of LAW feed to the WTP
- The WFD process strategy, as identified in the IWFDP Volume 1, Section 4.0; notable topical areas include:
  - Mitigation of waste in Waste Group A tanks
  - In-tank precipitation of the complexed strontium and transuranic (TRU) elements from the supernate currently stored in Tanks AN-102 and AN-107
  - Incidental blending of both solids (HLW feed) and supernate (LAW feed)
  - Intentional blending of solids, including blending of waste from Tank C-104 to reduce its fissile uranium concentration, metered blending of the high-zirconium waste stored in Tanks AW-103 and AW-105, and a blind blending of solids as part of the preparation of HLW campaigns
- Use of a “double-decant” during the preparation and delivery of LAW feed to the WTP to reduce the entrained solids concentration.

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5.0 WASTE FEED DELIVERY PROJECT PLANNING

This project plan is integrated with the System Plan (Rev. 6) Baseline Case operating scenario and the process strategy in IWFDP Volume 1, and supports the campaign plans described in IWFDP Volume 2. The project plan is built on lessons learned from the Hanford and Savannah River Site tank farms upgrades and waste feed operations, as addressed in a 2009 WFD value engineering workshop (RPP-RPT-49596, *WFD Optimization/Integration Value Engineering Workshop*), and other completed value engineering sessions conducted to optimize planning performance.

This project plan:

- Optimizes cost efficiency
- Improves schedule
- Mitigates risk
- Relies on mature technology where available
- Integrates upgrades with other tank farms work
- Places a high priority on operability and maintainability.

Flexibility is required in the planning process to adapt to evolving requirements, emerging issues, and process improvement opportunities. Examples include:

- Simplified pumps for use in DSTs without HLW sludge (e.g., simple submersible pumps versus flex and sink)
- Feed certification instrumentation and sampling system
- Combined and multi-tank support systems (control buildings, dilution and flush system)
- Early scheduling of tank farms infrastructure upgrades needed to support WFD.

The tank farms DSTs are typically outfitted with internal waste transfer pumps, transfer lines to the DST system, tank ventilation systems, slurry distributers for the receipt of waste from other tanks, temperature probes, liquid level gauges, and airlift circulators (in some cases). Figure 5-1 depicts some but not all of these components.

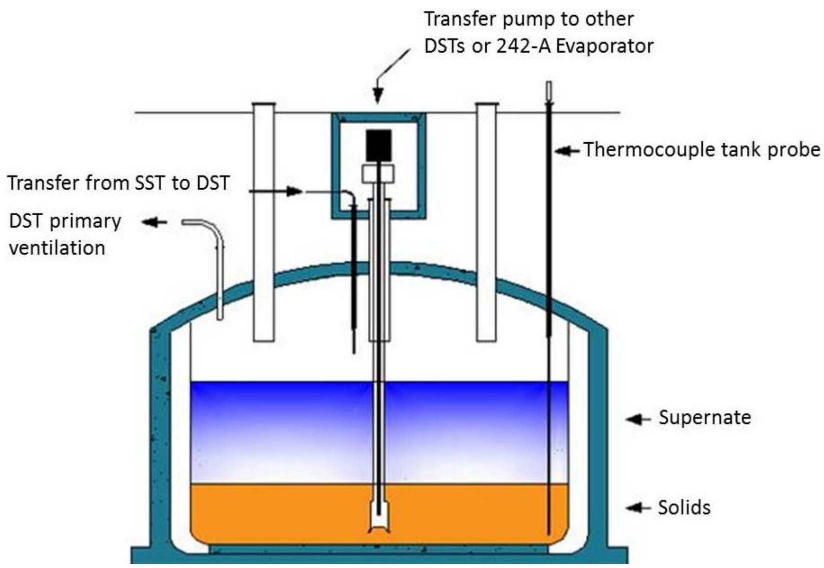

Figure 5-1. Typical Double-Shell Tank Configuration with Single Transfer Pump and Two Waste Phases

The existing DSTs, as shown in Figure 5-1, do not have the mixing capabilities to suspend the solids that have accumulated in the bottom of the tanks. The DSTs will require modifications to allow for adequate mixing of several feet of solids in a 75-ft diameter tank.

The baseline planning for the WFD program divides the DSTs functionally into four groups.

- The first group of tanks will be upgraded to support HLW (sludge) transfers—either DST-to-DST, or DST-to-WTP. The tanks used for sludge transfers will be outfitted with two 400-hp mixer pumps and a transfer pump designed to withstand the mixer pump jet forces. Any tank suitable for sludge handling is also suitable for supernate use, but the converse is not true.
- The second group of tanks will be used exclusively for LAW (supernatant) transfers. In general, the LAW tanks will only receive upgraded transfer pumps.
- The third group of DSTs contains significant quantities of saltcake solids. In these tanks, a single mixer pump may be installed to dilute and dissolve the saltcake.
- The fourth group of DSTs are planned to be filled with more solids that can be mobilized using incremental lowering of mixer pumps. These "deep-sludge" DSTs will require additional equipment, such as sluicers, to remove enough solids so that the remaining solids are within the solids-handling capabilities of mixer pumps.

Table 6-1 (Section 6.0) provides an outline of the planned equipment configuration for all 28 DSTs.

The planning to determine which tanks receive dual mixer pumps consisted of the following.

- If a tank currently has significant sludge inventory, dual mixer pumps are required to remove the waste.
- If a tank is planned for use as an HLW feed or staging tank, dual mixer pumps are required. The existing in-tank thermocouples will be replaced with those strong enough to resist the hydrodynamic forces from the discharge of 400-hp mixer pumps. The applicability of instruments to provide real-time indication of solids mobilization and suspension in the DST will be determined consistent with the results of the mixing and sampling demonstration (see Section 5.2).

The ability of mixer pumps to mobilize settled solids is dependent on the depth and properties of the solids. Solids that are too deep may not be effectively mixed, either because the solids layer prevents the pump from drawing in sufficient liquid or the total mass of solids is too great for the available pump horsepower. Computer modeling of the current jet mixer pump performance characteristics suggests that solids of a depth of up to 125 in. may be mobilized (IWFDP Volume 1, Section B2.3). For planning purposes, it is assumed that solids depths of greater than approximately 70 in. cannot be adequately mixed for sampling and delivery of feed to WTP (IWFDP Volume 1, Section B2.1) or for transfer to another DST without incremental lowering (IWFDP Volume 1, Sections B2.2 and B2.3).

The current Baseline Case is for 15 DSTs to be equipped with dual mixer pumps for HLW handling. These dual mixer pumps will be spread among all the DST farms except AP Farm, which will only be receiving LAW. All tanks equipped with dual mixer pumps will include incremental lowering of the mixer pumps due to current or planned depth of solids (sludge and/or saltcake). For sampling of HLW feed, sampling systems will be installed on tanks designated for feed delivery. Additionally, Tank AW-101, which will receive a single mixer pump, is expected to have incremental lowering because of the depth of saltcake waste in the tank.

Due to hydraulic concerns related to mixer pump suction, not all of the waste (liquid and solid) can be transferred out of the feed tank. Pump design limits specify that the transfers of HLW to WTP be terminated when there is less than 72 in. of total waste in the tank (IWFDP Volume 1, Appendix B, Section B2.5).

Mixer pumps installed in tanks containing LAW are planned only to assist in saltcake dissolution and are not required by ICD-19 to mix for certification or waste transfer. It is assumed that sampling of LAW feed tanks is accomplished using current grab sampling techniques.

The DSTs in Figure 5-2 accumulate HLW, including supernatant and solids, as depicted by the left tank for either transfer to another DST or delivery to the WTP. The HLW planned for delivery to the WTP will then be mixed thoroughly and transferred to WTP as feed. During the mixing process, the waste must be characterized to determine whether the contents meet the WTP waste acceptance criteria. Representative waste samples are assumed to be obtained using a remote sampler installed on the transfer pump recirculation loop. The mixing and sampling demonstration, discussed in Section 5.2 and IWFDP Volume 1, Section 2.8.8, is intended to define an achievable mixing and sampling strategy within the negotiated WTP waste acceptance criteria.

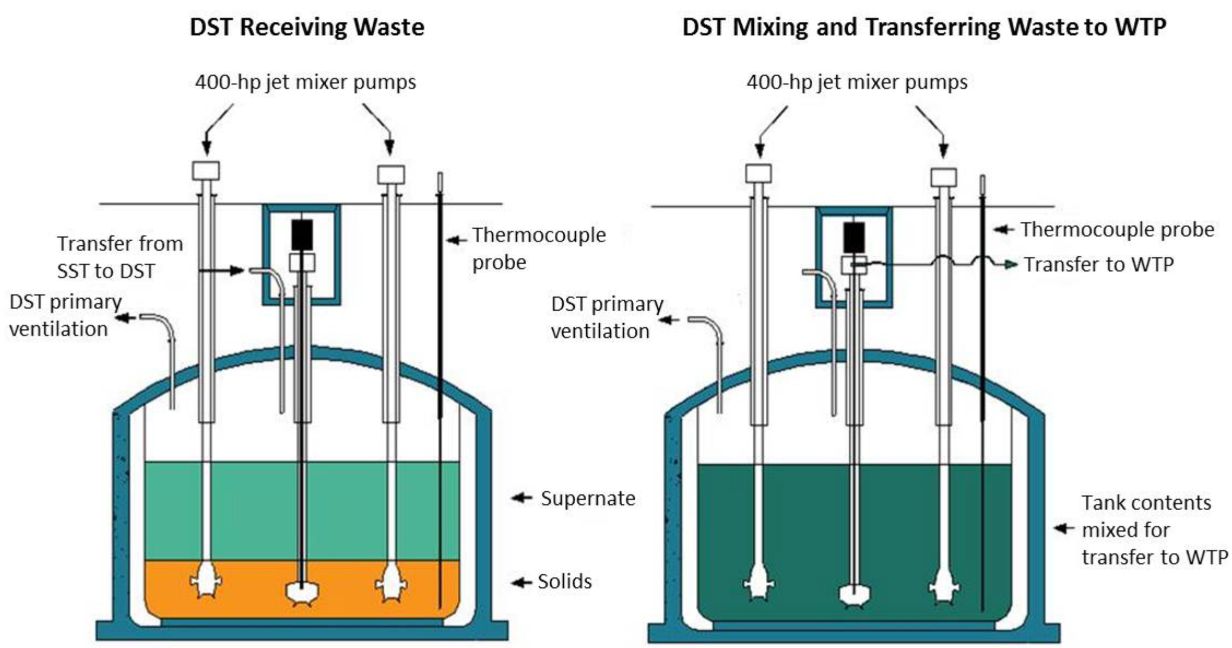

Figure 5-2. Upgraded Double-Shell Tanks with Installed Jet Mixer Pumps and Upgraded Transfer Pump

Another WFD challenge to be addressed is the mixing of deep sludge in DSTs. Several DSTs have or will receive several feet of solids (up to 20 ft, RPP-RPT-43828, *Enhanced Use of AN Farm for C Farm Single-Shell Tank Retrieval*) to accomplish the HLW feed delivery plan. Test data and computer modeling of the current jet mixer pump design indicates there is a limit to the depth of sludge in a DST that can be effectively mobilized by two 400-hp mixer pumps.

DSTs with sludge depths greater than the limits of mobilization will implement a design that allows for incremental lowering of the mixer pumps, along with a waste transfer pump with a variable height suction feature (see Figure 5-3). The mixer pumps and transfer pumps will be positioned in the DST sludge and operated such that successive "layers" of sludge are mobilized and transferred out of these deep sludge DSTs. The certification requirement (CR)-5 risk response (see Section 10.0, Table 10-1) includes addressing the deep sludge mixing challenge and the uncertainties associated with the model results on which this strategy is based.

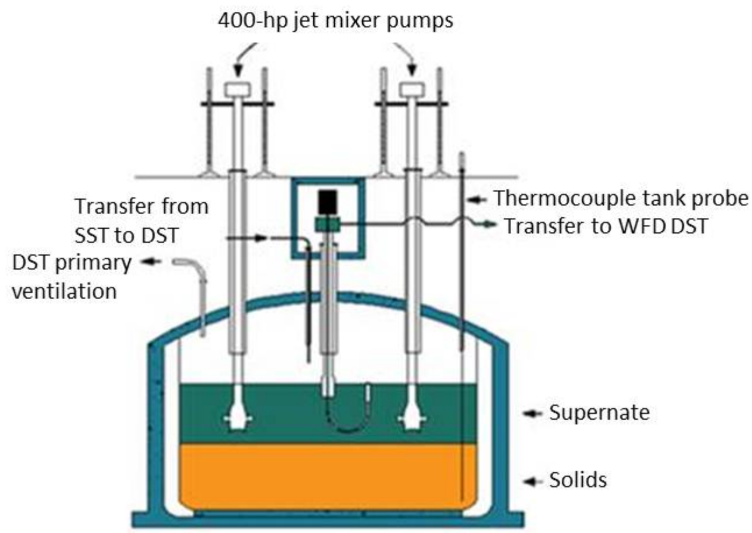

Figure 5-3. Double-Shell Tank with Variable Height Jet Mixer Pump and Variable Depth Transfer Pump

A related emerging challenge is that SST retrieval plans have changed since the System Plan (Rev. 6) Baseline Case assumptions were established. This change to a future Baseline Case operating scenario will consolidate the sludge originally planned for retrieval and storage in three deep sludge DSTs to use only two deep sludge DSTs. The anticipated solids height will exceed the capabilities of incremental lowering and may therefore require additional equipment, such as sluicers, to remove enough solids so that the remaining solids are within the solids-handling capabilities of mixer pumps.

AP Farm tanks are designated as supernate-only and as such will not receive solid wastes. Dedicated LAW transfer lines and tanks will be implemented due to concerns with solids cross-contamination from other HLW transfers. The tanks do contain some salts accumulated in the bottom of the tanks. The strategy for the LAW feed staging tanks is to place one 400-hp mixer pump in both Tanks AP-105 and AP-108, in the central pump pit 42-in. riser, and a transfer pump adjacent to the mixer pump in a 12-in. riser. The mixer pumps planned for saltcake tanks will be the same as those used in sludge tanks. Mixer pump operation is expected to be less extensive for saltcake dissolution than for sludge mobilization, requiring a frequency-controlled mixer pump to control the operating times by monitoring the salt dissolution (an endothermic reaction), as indicated by waste temperature.

Saltcake dissolution and waste retrieval may take weeks to months depending on the amount and composition of the saltcake present in Tanks AP-105 and AP-108. The sequencing of waste retrieval and feed from these DSTs is such that waste retrieval times are not critical to providing continuous LAW feed to the WTP. Although modifications may be needed to upgrade the DST system and equipment to safety-significant, this type of operation is less demanding on the tank ventilation system. The AP Farm ventilation system is being evaluated for safety-significant instrumentation.

5.1 PLANNING THAT SUPPORTS THE TECHNICAL BASELINE

Planning has been and will continue to be performed to develop programmatic requirements, define O&M concepts, address enabling assumptions, and provide risk mitigation. Testing will be performed to pursue technical maturation and demonstrate process operations.

The planning process included the review of basis documents, which were organized into general groups based on whether the study supported redefining the technical basis, planning O&M, or confirming an enabling assumption. The enabling assumptions are identified in the System Plan (Rev. 6) and in IWFDP Volume 1. Risk mitigation strategies are identified in Section 10.0 of this document and are managed according to TFC-PLN-39, *Risk and Opportunity Management Plan*. Technology maturation is described in Section 5.2.

The enabling assumptions in the System Plan (Rev. 6) and in IWFDP Volume 1 were used to produce the following guidance to support WFD project planning.

- Initial waste batches transferred to the WTP for hot commissioning will originate from the supernatant and solids stored in Tank AY-102.
- Process steps performed within the DSTs to support the Baseline Case will include, as a minimum, treatment of Envelope C waste (currently located in Tanks AN-102 and AN-107) to separate strontium and TRU constituents from supernatant.
- Selection of the sampling strategy and system equipment will determine the capability of providing a representative sample and a verification turnaround time that is equivalent to 210 days for each tank of HLW or LAW feed (per Assumption B3.2.3.11 in System Plan [Rev. 6]).

The System Plan (Rev. 6) emphasizes that DST space is extremely limited during the 2015 to 2025 period, limiting SST retrievals. DST space will become available when processing rates of the WTP and a second LAW facility have reached their full operating capacity and enough waste has been removed from the DSTs, allowing SST retrieval to resume. To continue retrievals between FY 2015 through FY 2025, additional pathways are needed and might include:

- Consolidating SST waste into sound SSTs
- Providing additional storage space via the proposed 200 East Area waste retrieval facility (WRF)[12]
- Early treatment of LAW
- Building new DSTs or other facilities
- Level rise transfer activities
- Development and deployment of the wiped-film evaporator for additional storage space.

Additional DST space may also be achieved through increasing supernatant specific gravity limits in DSTs and allowing for the formation of additional saltcake. Evaluation of these activities and future concepts for saving space are discussed in the System Plan (Rev. 6) and will be incorporated into the IWFD planning if and when they are selected for baseline implementation.

[12] High-level functions and requirements for the WRF are included in RPP-RPT-44860, *Mission Analysis Report Waste Feed Delivery Projects East Area Waste Retrieval Facility*.

5.2 TECHNOLOGY MATURATION AND DEPLOYMENT

The primary objective of the IWFD projects is to support timely and compliant delivery of waste feed to the WTP to safely and efficiently accomplish the RPP mission. As part of project rebaselining in 2009, a review of the technologies planned for deployment was performed. Details of the assessment are provided in Appendix M of RPP-40149 (Rev. 0). The assessment followed the guidelines contained in the *DOE Technology Readiness Assessment/Technology Maturation Plan Process Guide* (DOE 2008). Technology needs for SST retrieval and the analytical laboratories are outside the scope of this plan.

Twenty-two technologies or systems (new and existing) were initially considered. Of these, four were selected for further analysis:

- Mixer pump system
- HLW sampling system
- ^{90}Sr and TRU element precipitation process
- Mixer pump incremental lowering system.

The assessment concluded that the ^{90}Sr and TRU element precipitation process and the mixer pump incremental lowering system were at a technology readiness level (TRL) of 6 (engineering scale/prototypical systems tested in a relevant environment for design input, test, and engineering reports).

The purpose of the mixer pump incremental lowering system is to allow operation of a mixer pump without the pump being fully inserted into the DST. This is necessary because of the planned accumulation of deep sludge in some DSTs. The system mounts the mixer pump vertically on a moveable, pump support platform. The TRL of 6 is based on the successful use of this system at the Savannah River Site.

A TRL of 6 for the in-tank pretreatment process is based on laboratory testing of actual waste and pilot-scale testing of simulated waste at a sodium molarity of 5.5. This testing was performed to support implementation of the process at WTP. RPP-24809, *Strontium and TRU Separation Process in the DST System*, subsequently concluded that a large economic incentive exists for performing this process in-tank at the tank farms instead of in the WTP Pretreatment Facility. This possibility was most recently assessed in RPP-RPT-48340, *Evaluation of Alternative Strontium and Transuranic Separation Processes*. This report suggests conducting the process at an in situ sodium molarity of approximately 9.2 and with conditions for solids precipitation significantly different than those tested for implementation of the process at WTP might be desirable. Consequently, the work completed on the in-tank precipitation process at the high sodium molarity satisfies some of the criteria needed to reach TRLs from 1 to 4, but none of the levels have been fully completed. Additional testing will be required to confirm that the process will work under the recently proposed conditions.

Due to the uncertainty concerning the ability of the current mixer pump and HLW sampling systems to meet the sampling confidence requirements for waste acceptance at the WTP, some development work is necessary to establish system performance and evaluate it against waste acceptance requirements. The criteria for waste sampling and analysis are defined in ICD-19 (24590-WTP-ICD-MG-01-019) and other documents discussed in this volume.

An initial WTP waste acceptance criteria data quality objective (DQO) (24590-WTP-RPT-MGT-11-014, *Initial Data Quality Objectives for WTP Feed Acceptance Criteria*) defines the characterization and tolerance requirements needed to meet WTP safety and operating requirements. The DQO also identifies capabilities and requirement gaps that must be reconciled before feed can be delivered to the WTP.

If any of the system performance metrics do not meet the WTP waste acceptance criteria, the technology will be reevaluated for process improvements, coupled with different technology, or evaluated for replacement.

Major efforts in the mixing and sampling demonstration are described in IWFDP Volume 1.

5.3 PROJECT INTEGRATION

A series of life-cycle project upgrades and plant maintenance activities is underway to maintain DST facilities and prolong their operating life. Simple activities are conducted daily and coordinated during shift operations. Complex upgrades and major maintenance work are completed through plant outages. The upgrades associated with WFD (see Section 6.0) will require integration with day-to-day plant activities.

Activation of the cross-site slurry transfer system is also part of the CLIN 1 scope in support of WFD. Work breakdown structure (WBS) element 5.01.04.01.07.04 includes activities to complete the activation design, engineering, procurement, construction, and startup. An evaluation of the requirements to activate the cross-site slurry transfer system was recently completed and documented in RPP-RPT-47572, *Cross-Site Slurry Line Evaluation Report*. This activity is planned to start in late FY 2015 (see Section 7.5.1, Figure 7-3).

Interfaces include DST life extension projects, routine corrective maintenance, major plant upgrades, 222-S Laboratory transfers, SST retrieval transfers, and evaporator campaigns. All activities occurring in the DSTs will be coordinated with the IWFD projects workscope. Failure of critical tank farms support facilities (e.g., 242-A Evaporator or 222-S Laboratory) represents a significant risk and integration challenge for the life-cycle of the IWFD projects. The planned upgrades and other mitigating actions are intended to manage these risks. Section 10.0 discusses risks directly related to this project plan. Other TOC risks are described in TFC-PLN-39.

5.3.1 Double-Shell Tank Farm Life Extension Projects

A series of planned upgrades have been identified as DST life extension projects. The DSTs will receive several corrosion probes designed to allow continued function with varying tank levels without adverse effect. The probes will be designed to withstand the jet forces of the submersible mixer pumps. There are two out-of-service exhausters in AN and AW Farms that have been identified for removal. Several upgrades are in process for the ventilation system of AY and AZ Farms, including replacement of the 702-AZ Micon[13] computer system with ABB (ASEA Brown Boveri) technology. The ventilation systems in SY and AP Farms are currently in the process of being upgraded. All of the above upgrades are planned to finish prior to operating mixer pumps in the AY and AZ Farms.

[13] Micon is a trademark of Powell Industry, Inc., Houston, Texas.

In addition to the project upgrades, the facility conducts periodic maintenance outages that reduce the power to isolated sections or farms of the DST system. For the IWFD project upgrades, project outages will be coordinated with the maintenance outages to maximize the available craft resources and minimize the impacts to the facility.

Included in the TOC CLIN 1 scope is implementation of the tank farms monitoring and control system. Per TFC-PLN-118, *Strategic Plan for Hanford Waste Feed Delivery and Treatment Process Control Systems*, upgrades were performed during FY 2011 to enable tank and farm monitoring to be operational. The transfer system components (e.g., transfer pump controls) provided by the IWFD projects are designed to tie in directly to the master pump shutdown system (CLIN 1 scope). This function has not yet been tested and turned over.

The scope for CLIN 1 will provide AY/AZ, AW, and SY Farms with electrical infrastructure consisting of an instrument, control, and electrical building, and electrical substations with transformer upgrades. The CLIN 1 scope will also replace and upgrade the ventilation systems within these farms for future WFD support. The IWFD projects will provide WFD infrastructure consisting of dilution and flush systems and in-farm utilities, including dilution and flush piping to the valve pits and routing of WFD electrical and instrumentation to each tank. The CLIN 1 scope also includes replacement of the AP Farm ventilation system.

5.3.2 Single-Shell Tank Retrievals

The DSTs are the receiving tanks for near-term SST retrievals. The SST retrieval activity has been confined to C and S Farms, and is planned to start in A and AX Farms upon completion of C Farm retrievals. The retrieval of SST saltcake can result in significant dilute waste additions to the DSTs. This dilute waste is concentrated in the 242-A Evaporator to conserve space and support additional SST retrievals. Evaporator operations are controlled to preclude creating safety issues with waste storage. System Plan (Rev. 6), Appendix B, Sections B3.2.4 and B3.2.2.6, provide the assumptions governing evaporator operations and avoiding the creation of additional Waste Group A tanks. These are discussed in more detail in IWFDP Volume 1, Sections 4.4.5 and 4.4.6.

The retrieval construction, including installing hose-in-hose transfer lines, will be coordinated with the IWFD upgrades construction on a tank-by-tank basis. Retrieval transfers must be scheduled around in-tank IWFD upgrade activities, including tank intrusive work or mixing tests. Scheduling may mandate retrieval transfers on backshifts and weekends, while the upgrades and plant maintenance occur on dayshift. Some combination of activities using multiple shifts per day will provide the most efficient use of plant resources, while maintaining the schedule.

5.3.3 Evaporator Campaigns

To support continued retrieval activities, waste volume reduction by evaporation through the 242-A Evaporator is essential to the success of cleanup activities at Hanford tank farms.
The IWFD project upgrades will be scheduled around evaporator campaigns in accordance with the Baseline Case operating scenario documented in the System Plan (Rev. 6) and in IWFDP Volume 2, Section 6.0. On-the-fly adjustments to WFD project upgrade schedules, evaporator campaigns, and SST retrievals may be required to address actual progress and emerging field conditions.

5.3.4 222-S Laboratory Transfers

The waste from the 222-S Laboratory is received in SY Farm. These transfers nominally take one day and are not anticipated to impact any scheduled IWFD projects until the mixer and transfer pumps are installed in SY Farm. The laboratory transfers have dedicated routes that transfer directly into the tanks, bypassing valve and pump pits. Because of the short duration of the transfers and dedicated routes, coordination of the IWFD projects will be handled at the time of the transfers.

5.3.5 Blending and Staging Transfers

The blending and staging transfers necessary to prepare waste feed for the WTP will be coordinated directly with the IWFD projects. These transfers use the mixer pumps and transfer pumps installed by the IWFD projects. The sequence and timing of project installations documented in this project plan were integrated with the process strategy in IWFDP Volume 1 and the System Plan (Rev. 6) Baseline Case operating scenario. The HTWOS model was used to develop the projected transfers consistent with the process strategy and projected project schedule. The projected waste transfers for the System Plan (Rev. 6) Baseline Case operating scenario are provided in SVF-2111, "Transfers_4MinTimestep(6Melters)-mmr-11-031-6.5-8.3r1-2011-03-18-at-01-31-58_M1.xlsm."

5.3.6 Other Transfers and Miscellaneous Activities

The DST system periodically receives wastes from other sources, such as liquids resulting from pumping out catch tanks and inactive miscellaneous underground storage tanks to mobile regulated tankers. These transfers are infrequent and are coordinated through the Base Operations organization. This organization also transfers condensate directly to the Liquid Effluent Retention Facility during 242-A Evaporator campaigns. The transfers to the Liquid Effluent Retention Facility do not go through the DST system and thus will have no impact on the IWFD project upgrades.

As plant maintenance activities occur, the IWFD projects will be coordinated with Base Operations and other projects to determine the most efficient path forward to complete all the work identified with the least impact on other activities taking place at the time.

5.3.7 Safety-Significant Double-Shell Tank Primary Ventilation System

WRPS is currently elevating the safety importance of maintaining active primary ventilation at all times for the DSTs per ORP direction (Dowell and Bechtol 2011). A contract modification was provided by ORP, along with the directive to initially fund the engineering and proposal effort. The technical and cost proposal workscope addressed the items identified in the ORP directive, although at this time, funding for the proposed scope of work for implementing the DST ventilation systems strategy has not yet been provided. The work will be performed in two phases, as described below.

Phase 1 is broken down into Phases 1A and 1B. Phase 1A includes development of a safety basis amendment, approved by ORP on November 28, 2011 (Charboneau 2011), to designate the existing DST primary ventilation systems as safety-significant. RPP-RPT-49447, *Safety-Significant DST Primary Tank Ventilation Systems – Functions and Requirements Evaluation Document*, supports the safety basis amendment, as it identifies components of each DST ventilation system that need to meet safety-significant criteria and the areas that require upgrading as part of planned improvement activities that will be implemented in Phase 1B, and when funding is available.

Currently, Phase 1B work involves revising procedures and technical safety requirement controls, training, installing flow test ports in the ventilation duct downstream of the DST, and performing ventilation flow rate surveillance activities. Future Phase 1B proposed work includes continuous DST ventilation flow measurement, backup power, and underground ventilation duct integrity assessments, currently CLIN 1 workscope. As identified during ongoing gap analyses, planned improvements that include upgrading existing DST ventilation systems and components to meet safety-significant criteria will require coordination of the required modifications with available funding.

Phase 2 includes upgrading the DST primary ventilation systems cooling capacity to support future DST mixer pump operations. The first DST farm to receive this upgrade is the AY/AZ Farm. This ventilation system cooling capacity upgrade and its scope is further defined as a CLIN 3 project. Additional tank waste heat removal capacity will be required during operation of the mixer pumps to limit tank waste temperatures to 150°F for waste transfers to the WTP and 160°F for waste sampling operations. Upgrades to the DST primary ventilation systems will be determined by the waste cooling requirements, the control development process, and existing safety-significant controls as identified in RPP-RPT-49447. The upgrades will be scheduled to support the system planning models for the DST retrieval activities.

The safety-significant upgrades for the ventilation system are further captured under Risk S-26 (TOC-11-075) in the risk list provided in Section 10.0 and Appendix D.

5.4 UPGRADES APPROACH

The upgrades approach for this project plan is illustrated in Figure 7-3 (Section 7.5.1), which shows the timing of each IWFD project and the date selected for first used by the System Plan (Rev. 6) Baseline Case operating scenario. Specific upgrades for the tank farms are shown in Section 6.0, Figure 6-2 through Figure 6-7.

5.4.1 Project Timing

IWFDP Volume 1, Section 3.0, describes how the DSTs are used to implement the WFD process. The functional capability and availability of the DSTs are based on the planned configuration and upgrade project timing documented in this project plan. Volume 2 of the IWFDP describes the necessary upgrades and schedule for the first eight WFD campaigns.

5.4.2 Project Structure

The IWFD upgrades will be completed through a series of possible Category 2, expense-funded projects. The projects, summarized in Section 6.0, will use an EPCC approach. Each project or phase will be tailored to criteria in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. The IWFD project schedule will use the critical decision milestones described in TFC-PLN-84, *Tank Operations Contract Project Execution Plan*, with the WRPS approval authority, to ensure that IWFD projects meet the mission, design, and safety requirements. The DOE Office of Environmental Management Project Definition Rating Index will be used to evaluate the maturity of each project between the critical decision points up to project completion. It is anticipated that the majority of the individual projects will begin at CD-1 due to the maturity of the existing Project W-211 designs.

5.4.3 Project Execution

The WFD upgrades will approach each tank's upgrades and each tank farm's infrastructure upgrades as a separate project. The farm upgrades will include items such as electrical utilities, water, ventilation systems, and building upgrades, as required. The project will remove any obstacles or equipment that is no longer needed before, or in parallel with, the infrastructure upgrade. The tank upgrades will be scheduled (including contingencies) in parallel with or after the infrastructure upgrade, so that the pumping systems are installed shortly before their need date. Once a tank is outfitted with the mixer and transfer pumps, this equipment will be flushed and operated periodically to avoid plugged seals and seized bearings. The periodicity will be determined by the TOC Engineering organization based on information provided by the manufacturer of the pumps. The facility will be responsible for this routine maintenance once the equipment has been turned over to Operations.

5.5 CONSTRUCTION AND COMMISSIONING

This project plan is been constructed on a farm-by-farm, tank-by-tank basis, sequenced to support the IWFD project schedule provided in Section 5.4. Construction and commissioning activities for WFD will be closely coordinated with Base Operations and other tank farms project workscope to minimize schedule and cost impacts. Initial scopes of work in each tank farm will focus on upgrades and installation of common infrastructure (electrical distribution and ventilation upgrades, new diluent/flush systems, instrumentation control, and electrical buildings, etc.). Individual IWFD project upgrades throughout the DST farms will then be installed and tied into the IWFD system as the overall project schedule dictates.

5.5.1 Construction Approach

The IWFD project construction activities will be reviewed for applicability of the *Davis-Bacon Act of 1931* by undergoing a plant forces work review determination, as described in TFC-BSM-HR_EM–C-05, *Plant Forces Work Review*. WFD activities determined to be "applicable" by the DOE Richland Operations Office Labor Standards Board, will be managed by WRPS in accordance with TFC-PRJ-CM-C-01, *Construction Management*.

A Construction Manager will be assigned to the IWFD integrated project team (IPT) during the design phase of the project, preferably at conceptual design, to assist with constructability reviews and contracting strategies. At completion of detailed design, construction scopes of work will be subcontracted in accordance with TFC-BSM-CP_CPR-C-05, *Procurement of Services*. Construction subcontracts will be structured and scheduled for maximum efficiencies, by providing a steady flow of construction activities allowing for the development of an experienced labor force, which can then be maintained throughout the project duration. WRPS support personnel and subcontractors will be assigned as required to complete construction activities, with the goal to maintain a consistent project team through construction acceptance testing and turnover to Operations for final commissioning. Section 8.1 further describes the relationship between organizations within the IPT (e.g., performing the fieldwork as CLIN 1 scope on behalf of CLIN 3). Base Operations will release all the fieldwork, provide lock-and-tag support, and be responsible for maintaining safe work boundaries. Construction will be closely coordinated with day-to-day operations to minimize downtime and staff idle time. Construction activities will be integrated into TOC schedules to minimize risks related to concurrent operations.

The complexity of working within each farm is affected by the radiological and industrial hygiene controls applied to each construction area. All construction work will apply the integrated safety management system (ISMS) principles discussed in Section 12.2. During the construction planning process, the IPT will identify and evaluate potential hazards for the proposed scope of work in accordance with TFC-ESHQ-S_SAF-C-02, *Job Hazard Analysis*, and implement appropriate controls. The project will work with the radiological and industrial hygiene organizations to review area postings in proposed construction zones, to assure that they reflect the minimum level of controls required and also that the postings aren't too restrictive. If down-posting is feasible for a section of the farm, the project will modify farm boundaries and/or postings accordingly. At the conclusion of the project workscope, farm boundaries and postings will be reestablished as directed by Base Operations. This process will make the work area safer by eliminating stress and hazards to workers caused by unnecessary personal protection equipment, in addition to providing cost savings and schedule efficiencies to the project by eliminating unnecessary controls.

Upon completion of fieldwork or portions of the work related to construction tasks, walkdowns will be performed and documentation completed in accordance with TFC-PRJ-CM-C-08, *Construction Completion, and Turnover*. Any punchlist items will be documented on an exceptions list and included with the construction completion document. On completion of all required punchlist actions, the contract or portions of the contract will be formally accepted by WRPS and turned over to Operations for commissioning.

5.5.2 Commissioning Approach

The IWFD system will be commissioned using a process similar to the U.S. Nuclear Regulatory Commission inspection, testing, analysis, and acceptance criteria (ITAAC) approach described in TFC-PLN-98, *Inspections, Tests, Analysis, and Acceptance Criteria (ITAAC) Program Plan*. The ITAAC process will deploy a "readiness to commission tool" that will be a part of the design phase for the system, track the ITAAC requirements, form the foundation of the test plan acceptance criteria, and ensure that systems designed and built will work as planned.

The designs for the scope of this project plan will be standardized. Mixer pumps, transfer pumps, and infrastructure designs will be similar from farm to farm. This approach will simplify the commissioning process so that successive testing, readiness, and turnover activities will be simplified after the first deployment. The IWFD projects will build on the successes of the first installation to gain experience and incorporate lessons learned for subsequent installations. The readiness and turnover steps will be done on each individual farm or system. A readiness activity description and turnover-scoping document will be prepared for each system. From the activity description, the level of readiness will be determined using a graded approach described in TFC-PRJ-PM-C-04, *Startup Notification Report*. Both a project turnover document and a project closeout report will be developed based on TFC-PRJ-PM-C-28, *Project Turnover and Closeout*, and the project turnover scoping document. Deliverables to be turned over by the project will be identified in the project turnover document. A description of the operational readiness process is provided in TFC-PRJ-PM-C-06, *Operational Readiness Process*. As a minimum, the project will provide the design media, all testing results, operating procedures, training materials, O&M materials and requirements for the system, and the calibration materials necessary to maintain the system.

The control system will be mocked up and tested at a vendor facility or at a WRPS-controlled facility to demonstrate the system capabilities. This demonstration will be done prior to connecting any of the control system to tank-intrusive installations. If the equipment is unavailable, then simulators will substitute for the target equipment. Prior to installation onsite, the software used in the control system will undergo a verification and validation process at the vendor facility or during mockup testing. The rigor of the verification and validation will be commensurate with the safety classification of the system. The control system test bed or mockup will be used to develop procedures, train operators, and develop responses to upset conditions. This WFD-specific training will support the readiness and turnover activities.

The final demonstration in the commissioning process of the IWFD system will involve “hot testing” (testing with radioactive materials). Wherever practical, the system will be tested by running the transfer pumps installed in the waste tank in a recirculation mode so that the discharge of the transfer pump is routed directly back into the tank. The mixer pumps installed in the tank will be operated at different speeds, discharge nozzle orientations, and tank depths to demonstrate the mixing capabilities of the design. These operations will test the complete IWFD system using actual waste to demonstrate that the system mixes waste adequately, and that it will meet transfer flow requirements.

5.6 OPERATIONS AND MAINTENANCE

The IWFD system will be operated and maintained by Operations personnel within the design basis and environmental and nuclear safety envelopes (described further in Section 8.0). Execution, maintenance, and readiness for WFD will be funded by CLIN 1; engineering and design will be funded by CLIN 3. The current and expected requirements establish the foundation for successful execution of the WFD mission. Current requirements support safe storage of tank waste, and future requirements will include WFD. The WFD transfer systems and subsystems that have been turned over to the Operations organization are available to support the overall TOC mission. This includes DST-to-DST transfers, evaporator campaigns, and sampling evolutions prior to WTP startup and when not feeding the WTP.

HNF-1939, *Waste Feed Delivery Technical Basis, Volume IV, Waste Feed Delivery Operations and Maintenance Concept,*[14] describes how the IWFD system will be operated to meet the mission requirements for delivery of retrieved waste from Hanford DSTs to the WTP. This O&M concept presents the general operational philosophy and tenets that guide the development of WFD operations and describes the facility requirements for O&M to accomplish WFD simultaneously with normal operations.

IWFDP Volumes 1 and 2 present the plan for optimum and reliable pretreatment, blending/mixing, retrieval, and delivery of feed to ORP treatment facilities. This plan includes the needs of commissioning, near-term and long-term operations, necessary studies, testing and infrastructure installation, and projected waste transfer/pretreatment operations.

This project plan (IWFDP Volume 3) defines the scope of work, objectives, and project management approach to achieve the TOC WFD objectives. The scope of work includes project planning, EPCC of the system upgrades, coordinating project activities with the existing plant operations, and operating the IWFD systems.

The Operations organization will develop and issue training materials, operating procedures, alarm response procedures, maintenance procedures, and operator surveillance logs based on facility design and the results of operational acceptance testing. When operational acceptance testing is complete and the results are approved, the modification will be turned over to Operations for use in accordance with approved operating procedures.

Fully functioning Base Operations and Maintenance Program & Control organizations will be essential to perform risk-mitigating maintenance actions to support the WFD mission. To support the anticipated work pace during WFD, the operations and maintenance organizations must be prepared to restore system operability. Work packages must be pre-planned to anticipate key maintenance actions to be responsive to WFD mission requirements. Maintenance facilities must be available for technology development, hands-on mock-up training, maintenance on contaminated equipment, and storage of replacement parts. An O&M concept is being prepared to describe how the physical WFD systems will be operated and maintained under normal and off-normal conditions. The O&M concept may identify feedback in the form of issues or gaps from an O&M perspective.

5.6.1 Approach to Operations of the Waste Feed Delivery System

The primary objective of the IWFD projects is to support timely and compliant delivery of waste feed to the WTP to safely and efficiently accomplish the RPP mission. Base Operations will be responsible for the waste transfers. Waste will be retrieved from older SSTs and transferred to the newer DSTs. The waste will be stored in DSTs, mixed in-tank, sampled and characterized, and transferred to the WTP. The WTP will pretreat, then vitrify LAW and HLW, and place the glass into stainless steel canisters. Immobilized low-activity waste (ILAW) will be disposed onsite at the Integrated Disposal Facility. Immobilized high-level waste (IHLW) will be stored onsite on an interim basis pending identification of a permanent disposal pathway.
The 242-A-Evaporator (and/or other technology, such as the wiped-film evaporator) will provide waste volume reduction to free up DST space for additional SST retrievals.

[14] HNF-1939 is being updated and replaced by RPP-50134, *Waste Feed Delivery Operations and Maintenance Concept*.

WFD operations are focused on transferring, receiving, preparing, staging, and delivering LAW and HLW feeds to the WTP. The feed qualification process requires that each tank of feed be mixed and sampled to certify that it meets WTP feed acceptance criteria prior to transfer. These sampling and transfer activities will be in addition to the Base Operations scope necessary to support SST retrieval, 242-A Evaporator operations, and feed blending and staging.

Operator proficiency will be developed by training on a WFD simulator, participating during the operational acceptance testing, performing routine surveillances on the system, and participating in drills to demonstrate familiarity with alarm response procedures and actions.

5.6.2 Approach to Preventive Maintenance of the Waste Feed Delivery System

The goal of the preventive maintenance program is to maximize WFD equipment availability through the use of a predictive maintenance and condition monitoring program and to run equipment “almost to failure” prior to replacement. In addition, O&M practices must incorporate improvements to corrective maintenance responsiveness. These improvements include purchasing more reliable equipment, increasing the use of installed spares, and actively preparing for failures of components that have large restoration times. The risk of not establishing a preventive maintenance program is that critical component failures during WFD to the WTP have the potential to idle WTP facilities (i.e., if the duration of the recovery operations is long enough that internal lag-storage of the WTP is depleted or if contingency feed is not available or cannot be delivered due to a common-mode failure). RPP-RPT-47178, *Waste Feed Delivery Maintenance System Review*, has evaluated and recommended preventive maintenance goals and objectives for successful WFD to WTP.

The IWFD system will require maintenance and equipment replacements to support timely delivery of feed to the WTP throughout the RPP mission (i.e., through 2047). The System Plan (Rev. 6) Baseline Case operating scenario estimates more than 6,000 tank waste transfers to support treatment of all tank waste and tank farm closures. These transfers include flush water and chemical additions. The type and periodicity of maintenance is established by TOC Engineering. Preventive maintenance takes into consideration the operational history of the equipment, input from maintenance craft, technical safety requirements, and vendor-suggested maintenance and codes and standards (e.g., National Electric Code, Washington Administrative Code [WAC], and environmental regulations), and results from the WFD operations research model.

In addition, results from the WFD operations research model indicate that significant delays are expected, if the current tank farms reliability and maintenance practices are employed during WFD system operations. Interviews with maintenance personnel indicate that the current staffing level is sufficient to manage maintenance related to the current workload. It is anticipated that the operations workload will increase substantially during WFD operations, which will need to be supported by additional maintenance personnel.

Preventive and predictive maintenance (e.g., functional checks, calibrations, mechanical inspection, and cleaning) of equipment listed in the master equipment list are identified and tracked in the computerized history and maintenance planning software (CHAMPS) system. Work is accomplished using instructions that clearly define the scope and provide sufficient detail to identify and mitigate potential hazards, complete the maintenance requirement, and document the results. The level of detail in the work instructions is commensurate with the difficulty of the task. When it is determined that a preventive maintenance activity is no longer required to support the RPP mission, that activity is discontinued in CHAMPS. Selected equipment not routinely used may not have periodic preventive maintenance performed, but is calibrated or otherwise maintained before use.

The readiness capability for WFD must include additional labor personnel to support the shift-work requirements, and for spare parts management and maintenance facilities to support maintenance of the WFD subsystems as needed. The ability to accomplish RPP mission goals depends on the use of experienced, well-trained, and competent maintenance personnel. Maintenance facilities must be available for hands-on mock-up training, maintenance on contaminated equipment, and replacement parts storage.

5.7 DOUBLE-SHELL TANK FINAL RETRIEVAL AND CLOSURE

The retrieval systems planned for WFD are expected to remove the majority of waste (solids and liquids) from the DSTs. Near the end of the waste treatment mission, fewer DSTs are needed to support SST retrievals and to prepare and deliver feed to the WTP. The waste from unneeded DSTs will be transferred to other in-use DSTs, flushed, and then turned over to a Retrieval and Closure organization for final cleaning and closure. It is assumed that 99.9 percent of the waste in each tank will be retrieved with chemical wash tank cleaning coupled with the mobile retrieval system and the vacuum-based retrieval system (DOE/EIS-0391, *Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, Volume 1 [TC & WM EIS]). When a tank is no longer needed for WFD or other Base Operations work, it will be transitioned to Retrieval and Closure. This Retrieval and Closure group will be responsible for removing any final waste or equipment to meet closure criteria. Additional information regarding the retrieval and closure of DSTs is provided in Appendix B of IWFDP Volume 2.

5.8 WASTE TREATMENT AND IMMOBILIZATION PLANT INTERFACE, ONE SYSTEM

The TOC (DE-AC27-01RV14800, Modification 089) includes requirements for WRPS to closely integrate tank farms activities with the WTP. This integration is primarily addressed by TOC CLIN 3, “Waste Treatment and Immobilization Plant (WTP) Support,” which includes the following scope:

- Sub-CLIN 3.1 includes scope for ICD management, including ICD-19, DQO process, waste acceptance criteria, system planning, project planning, retrieval and transfer system upgrades, tank waste inventory management, IHLW storage and disposition planning, waste pretreatment and staging, DST retrieval, and feed delivery operations.

- Sub-CLIN 3.2 includes a plan for WTP operational readiness support. The plan will provide a time-phased approach for review of each WTP facility to identify operational concerns, issues, risks, gaps, and vulnerabilities, and will address each of the following topical areas:
  - Process flowsheet viability
  - Reliability, availability, maintainability, and inspectability
  - Training and testing activities
  - Cold and hot commissioning.
- Sub-CLIN 3.3 includes scope for constructing interim storage for the WTP IHLW, and for transporting IHLW and ILAW from WTP to storage or disposition locations.
- Sub-CLIN 3.4 includes scope to upgrade and operate the Effluent Treatment Facility to treat and dispose of WTP secondary liquid wastes.

In addition to the sub-CLIN 3.2 activities discussed above, other initiatives are currently being considered that would further strengthen the WRPS interface with WTP. For example, WRPS and WTP have implemented a “One System Project Team” for the management and integration of interfacing scope (RPP-51471, *2020 Vision One System IPT Charter*). The primary objective of the One System approach is to assure successful completion of the activities needed to achieve WTP initial plant operations by 2018 to meet TPA (Ecology et al. 1989) and Consent Decree (2010) commitments, lower costs and risks, and accelerate completion of the RPP mission. The One System integrated approach for managing WFD and WTP startup provides for:

- Ensuring flexibility in managing solutions to technical issues
- Aligning the TOC and WTP contract to a common waste treatment processing focus
- Reducing WTP facility startup risk
- Implementing joint accountability to meet milestones.

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6.0 WASTE FEED DELIVERY PROJECTS BASELINE AND REPORTING

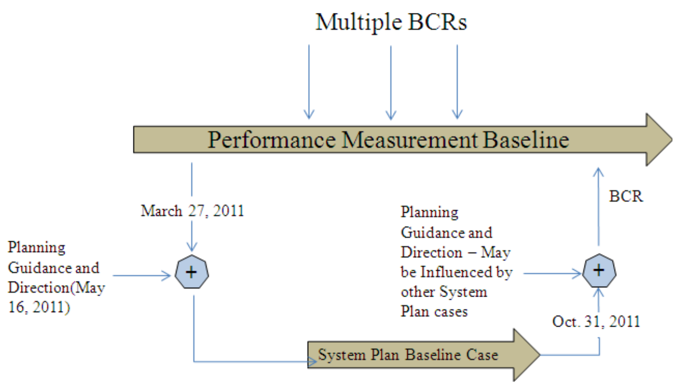


Figure 6-1. Performance Measurement Baseline Development

Revisions of the IWFDP and System Plan are linked to revisions of the TOC performance measurement baseline (PMB) (Figure 6-1). At the outset of developing each new System Plan, planning guidance and direction from ORP are incorporated into the key assumptions for the new Baseline Case. Upon ORP approval of the assumptions, the scope of the System Plan is defined. Changes to the PMB are controlled through the baseline change request process. Upon completion of the current System Plan, Baseline Case results are reviewed. These results, along with emergent planning guidance and direction related to funding, schedule, or other matters, are captured in one or more new baseline change requests for incorporation into the PMB. Subsequently, other baseline change requests also may be incorporated in the PMB until the completion of this iteration of the System Plan, at which point the entire cycle starts over. In this way, alignment between the PMB and the System Plan is maintained, as referenced in System Plan (Rev. 6), Sections 1.8 and 5.0.

The project plan baseline scope is summarized in Figure 6-2 through Figure 6-7 (at the end of this section). These summaries include the anticipated scope for all DSTs, but indicate which projects are planned for the contract period and for the period beyond FY 2018. The AY and AZ Farms are summarized together because of their close proximity and identical waste storage scope. As discussed in Section 7.0, proposed realignment of certain upgrade project baselines is also identified.

In general, the IWFD system is made up of smaller projects called IWFD projects, which include (1) the mixer and transfer pumps necessary to mobilize and remove solids and supernate from the DST, certification test loop, and support equipment, and (2) facilities needed to operate and monitor retrieval equipment. If a DST is one of the designated HLW feed tanks, the certification test loop will also be a key element of an IWFD system. The IWFD projects must also remove and dispose of existing equipment to allow installation of the new mixing and retrieval systems. Any waste tank modifications and utility upgrades are covered in a separate WFD tank farms infrastructure project.

Table 6-1 (at the end of this section) summarizes the planned upgrades for each DST and tank farm. Some upgrades are currently in process. As these activities are completed, Table 6-1 will be updated.

Changes to the project technical, schedule, or cost baseline are authorized by approval of a baseline change request, in accordance with TFC-PRJ-PC-C-12, *Baseline Change Control*.

Project performance will be measured and reported against the project-approved baselines using the WRPS earned value management system described in RPP-7725, *Washington River Protection Solutions LLC Project Control System Description.*

Project planning and performance reporting will be accomplished by a compilation of data provided to the project manager from the performing organizations and the project controls specialist. Supporting subcontractors will also provide monthly status, via the project manager, for work in progress.

Each month, the performing organizations report progress to the project controls specialist, who reviews the reports and forwards them with earned value data to the project manager. Reports are formatted to WRPS requirements for submittal to ORP. These reports include variances and any proposed corrective actions at the respective level of detail. Earned value data are the basis for assessing performance from both a cost and schedule perspective. These data are used in cost control and schedule execution decisions.

Project management will execute periodic reviews of the activities associated with the in-tank upgrades project in accordance with TFC-PLN-83, *Assurance System Program Description*.

IWFD PROJECT AN FARM UPGRADES LIFE-CYCLE SCOPE

SUMMARY SCOPE:

AN Farm Infrastructure (*BCR needed for New Scope Start FY 2012)* & Ancillary Systems
- Electrical capacity upgrade & utilities to tanks
- Instrument/Control/Electrical Building
- Diluent/Flush system planned as shared with AY/AZ Farms diluent/flush system

AN-101 Feed Delivery System – *FY 2017 Start*
- Remove 1 transfer pump, 1 T/C tree, 1 slurry distributor
- Install 2 submersible mixer pumps with incremental lowering devices **[1]**, 1 variable decant depth transfer pump **[2]**, 1 variable slurry depth transfer pump **[3]**, 1 T/C tree

AN-102 Feed Delivery System – *FY 2020 Start*
- Remove 1 transfer pump, 1 T/C tree, 2 corrosion probes, 1 slurry distributor
- Install 2 submersible mixer pumps **[4]**, 1 variable decant depth transfer pump **[5]**, 1 fixed full depth transfer pump **[6]**, 1 T/C tree

AN-103 Feed Delivery System – *FY 2018 Start*
- Remove 1 transfer pump, 1 T/C tree, 1 MIT, 1 slurry distributor, 1 camera-multiport
- Install 2 submersible mixer pumps with incremental lowering devices **[7]**, 1 variable decant depth transfer pump **[8]**, 1 variable slurry depth transfer pump **[9]**, 1 T/C tree

AN-104 Feed Delivery System – *FY 2015 Start*
- Remove 1 transfer pump, 1 T/C tree, 1 MIT, 1 corrosion probe, 1 slurry distributor, 1 camera-multiport
- Install 2 submersible mixer pumps with incremental lowering devices **[10]**, 1 variable decant depth transfer pump **[11]**, 1 variable slurry depth transfer pump **[12]**, 1 new T/C

AN-105 Feed Delivery System – *FY 2023 Start*
- Remove 1 transfer pump, 1 T/C tree, 1 MIT, 1 corrosion probe, 1 slurry distributor, 1 camera-multiport
- Install 2 submersible mixer pumps with incremental lowering devices **[13]**, 1 variable decant depth transfer pump **[14]**, 1 variable slurry depth transfer pump **[15]**, 1 T/C tree

AN-106 Feed Delivery System – *FY 2013 Start*
- Remove 1 mixer pump, 1 transfer pump, 1 T/C tree, 1 slurry distributor
- Install 2 submersible mixer pumps with incremental lowering devices **[16]**, 1 variable decant depth transfer pump **[17]**, 1 variable slurry depth transfer pump **[18]**, 1 T/C tree

AN-107 Feed Delivery System – *FY 2022 Start*
- Remove 1 mixer pump, 1 transfer pump, 1 T/C tree, 2 corrosion probes
- Install 1 submersible mixer pump **[19]**, 1 fixed full depth transfer pump **[20]**, 1 T/C tree

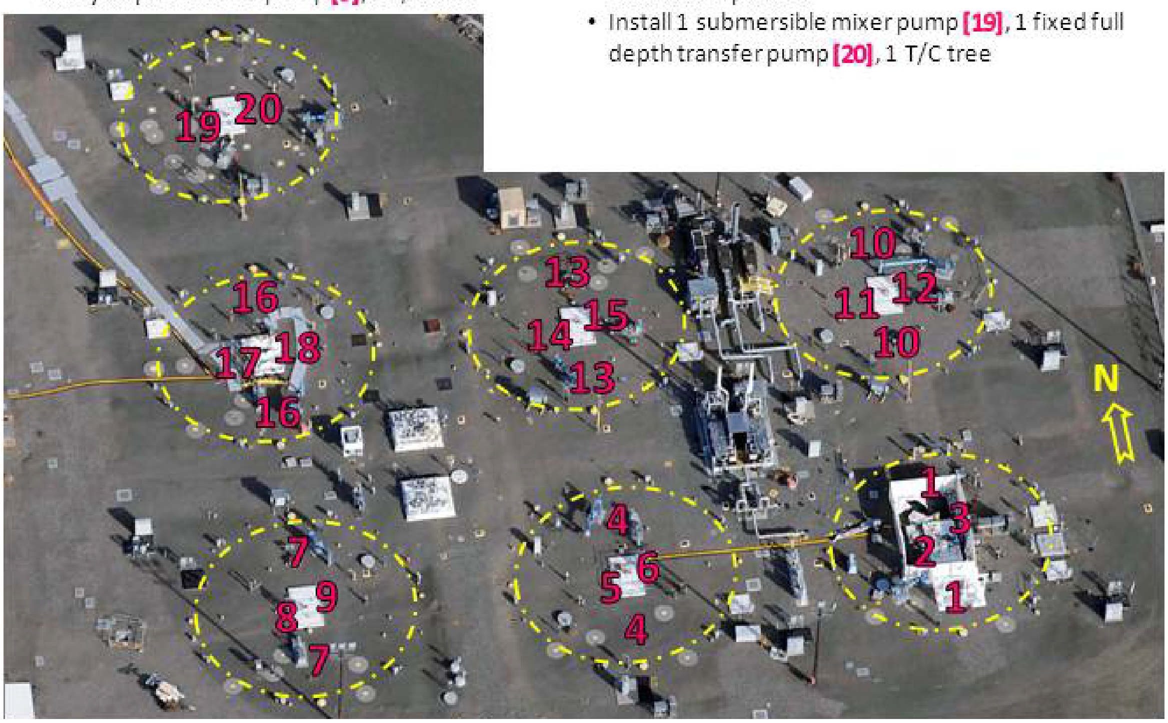
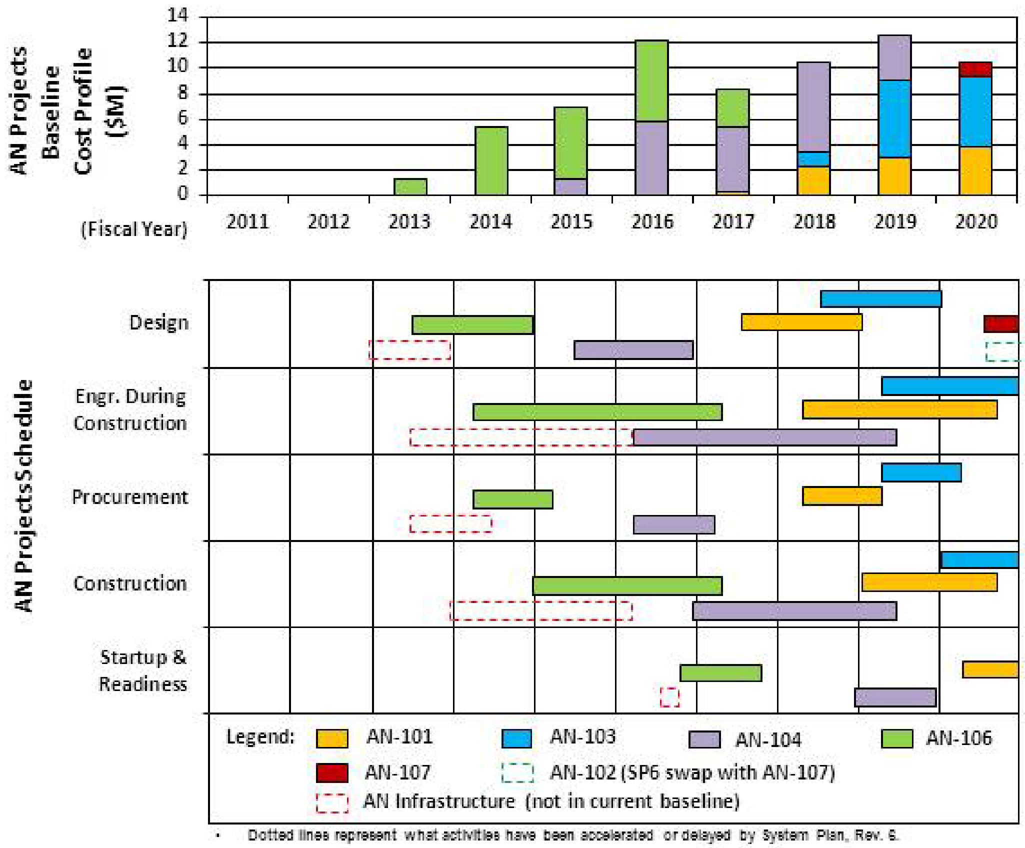


Figure 6-2. Integrated Waste Feed Delivery Project AN Farm Upgrades (2 pages)

IWFD PROJECT AN FARM UPGRADES "10-YEAR" BASELINE



APPROACH:

Construction on a farm basis integrated with outages, CM, & DST Life Extension. AN infrastructure separated from AY/AZ infrastructure as new scope requiring BCR to begin work in FY 2011. Tank AN-106 first followed by AN-104, AN-101, & AN-103. Standardized pump designs installed shortly before need date. Turnover by sub-project preferred; partial turnover on as-requested basis.

MAJOR DELIVERABLES MILESTONES:

- Final designs
- Receipt of equipment procurements
- Construction completion documents
- Confirmation of readiness for feed delivery

KEY DEVELOPMENT SUPPORT AREAS:

- Mixer pump scale testing
- Sampling methodology development
- AY-102 Technology Maturation Mixing/Sampling Demonstration
- Technology maturation needed for AN-102/AN-107, Sr/TRU precipitation process

Figure 6-2. Integrated Waste Feed Delivery Project AN Farm Upgrades (2 pages)

IWFD PROJECT AP FARM UPGRADES
LIFE-CYCLE SCOPE

SUMMARY SCOPE:

AP Farm Infrastructure *(BCR needed to realign FY 2013 to FY 2016 Start)* & Ancillary Systems
- Electrical capacity upgrade **[1]**
- Instrument/Control/Electrical Building upgrades
- Utilities to tanks
- Diluent/Flush system planned as shared with AW Farm diluent/flush system **[2]**
- Primary exhauster replacement *(funded in CLIN1 FY 2010 Start)*

Dedicated LAW Transfer Line *(BCR needed for New Scope Start FY 2018)*
- New underground transfer line from AP Farm to WTP

AP-101 Feed Delivery System – *FY 2017 Start*
- Remove & dispose 1 transfer pump
- Install 1 fixed full depth transfer pump **[3]**

AP-102 Feed Delivery System – *(BCR needed to realign FY 2023 to FY 2017 Start)*
- Remove & dispose 1 transfer pump
- Install 1 fixed full depth transfer pump **[4]** (02D pit)

AP-103 Feed Delivery System – *FY 2026 Start*
- Remove & dispose 1 transfer pump
- Install 1 fixed full depth transfer pump **[5]**

AP-104 Feed Delivery System – *(BCR needed to realign FY 2024 to FY 2016 Start)*
- Remove & dispose 1 transfer pump
- Install 1 fixed full depth transfer pump **[6]**

AP-105 Feed Delivery System – *FY 2023 Start*
- Remove & dispose 1 transfer pump, 1 T/C tree, 1 slurry distributor
- Install 1 submersible mixer pump **[7]**, 1 fixed full depth transfer pump **[8]**, 1 T/C tree

AP-106 Feed Delivery System – *(BCR needed to realign FY 2026 to FY 2019 Start)*
- Remove & dispose 1 transfer pump
- Install 1 fixed full depth transfer pump **[9]**

AP-107 Feed Delivery System – *FY 2027 Start*
- Remove & dispose 1 transfer pump
- Install 1 fixed full depth transfer pump **[10]**

AP-108 Feed Delivery System – *(BCR needed to realign FY 2018 to FY 2020 Start)*
- Remove & dispose 1 transfer pump, 1 T/C tree, 1 slurry distributor
- Install 1 submersible mixer pump **[11]**, 1 fixed full depth transfer pump **[12]**, 1 T/C tree

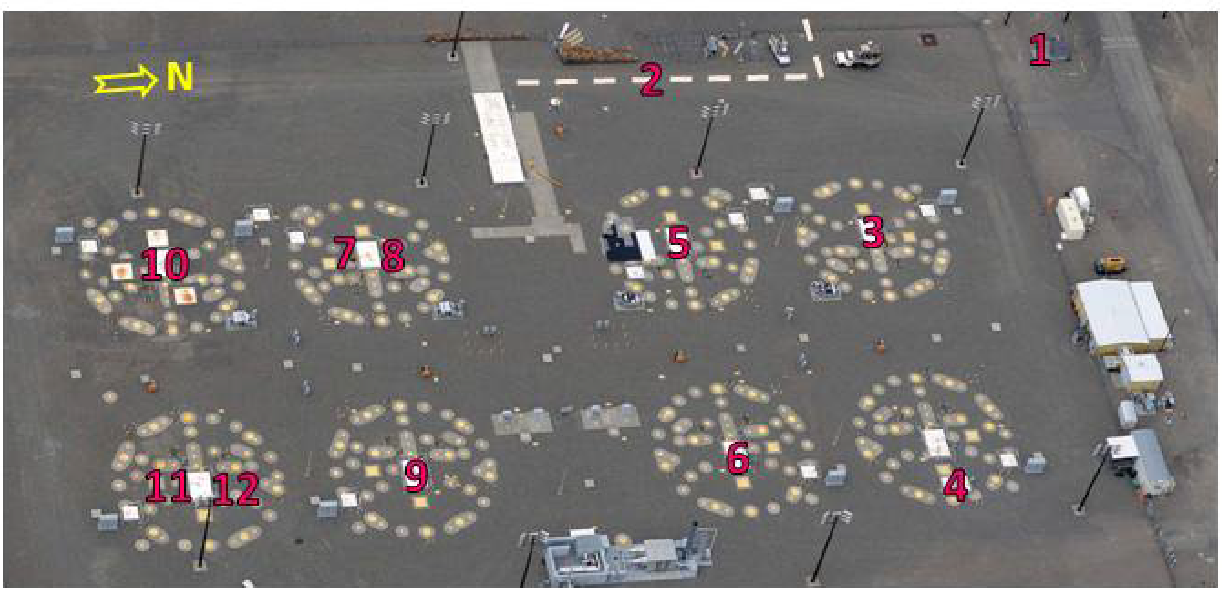
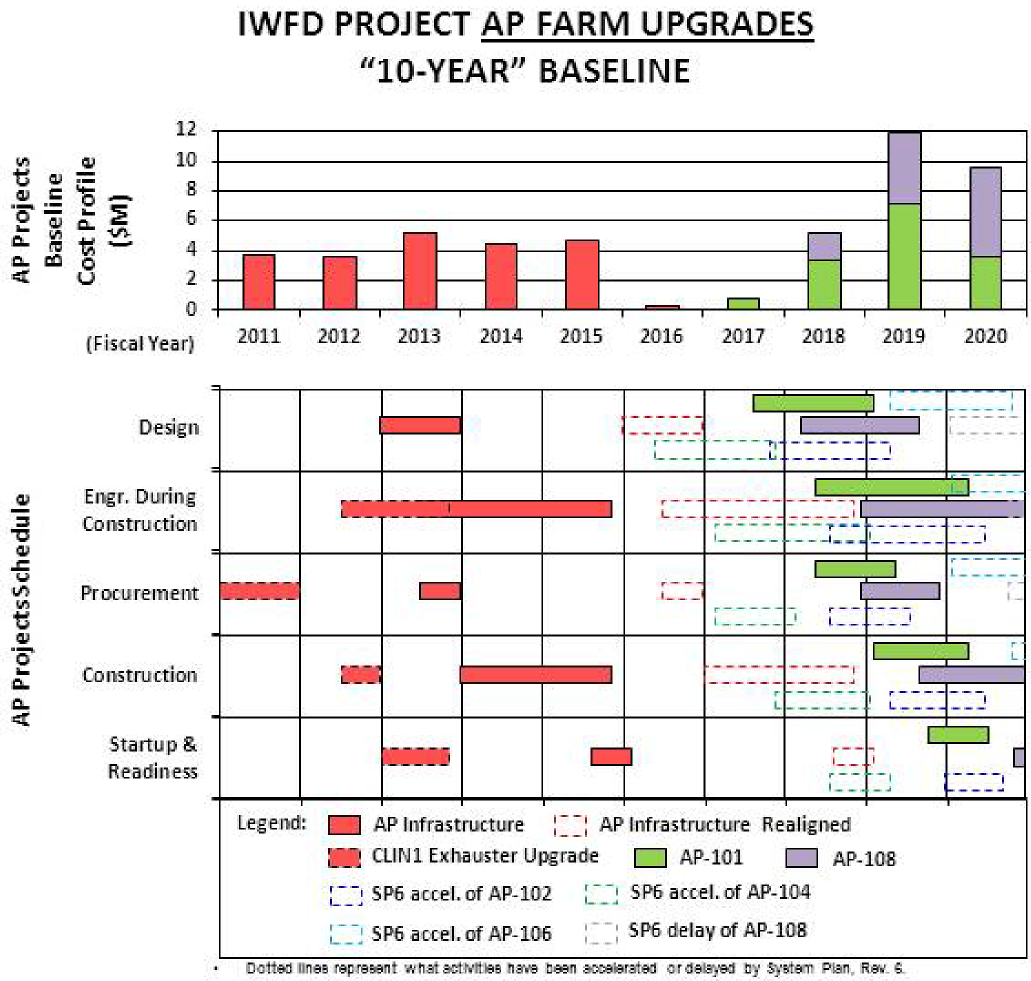


Figure 6-3. Integrated Waste Feed Delivery Project AP Farm Upgrades (2 pages)



APPROACH:

Construction on a farm basis integrated with outages, CM, & DST Life Extension. AP Infrastructure schedule is currently accelerated ahead of need date. BCR is needed to realign infrastructure start date from FY 2013 to FY 2016. AP Farm Infrastructure first followed by AP-101 & AP-108. Standardized pump designs installed shortly before need date. Turnover by sub-project preferred; partial turnover on as-requested basis.

MAJOR DELIVERABLES MILESTONES:

- Final designs
- Receipt of equipment procurements
- Construction completion documents
- Confirmation of readiness for feed delivery

KEY DEVELOPMENT SUPPORT AREAS:

- Mixer pump scale testing
- Sampling methodology development
- AY-102 Technology Maturation Mixing/Sampling Demonstration

Figure 6-3. Integrated Waste Feed Delivery Project AP Farm Upgrades (2 pages)

IWFD PROJECT AW FARM UPGRADES
LIFE-CYCLE SCOPE

SUMMARY SCOPE:

AW Farm Infrastructure *FY 2009 Start* & Ancillary Systems
- Electrical capacity upgrade **[1]** and Instrument/Control/Electrical Building **[2]** *(funded in CLIN 1)*
- Utilities to tanks
- Diluent/Flush system planned as shared with AP Farm diluent/flush system **[3]**
- COBs isolation--***Complete***

AW-101 Feed Delivery System – *FY 2019 Start*
- Remove & dispose 1 transfer pump, 1 T/C tree, 1 MIT, 1 slurry distributor
- Install 1 submersible mixer pump with incremental lowering device **[4]**, 1 fixed full depth transfer pump **[5]**, 1 T/C tree

AW-102 Feed Delivery System – *FY 2028 Start*
- Remove & dispose 1 transfer pump, 1 T/C tree, 1 ALC
- Install 1 submersible mixer pump **[6]**, 1 fixed full depth transfer pump **[7]**, 1 T/C tree

AW-103 Feed Delivery System – *FY 2012 Start*
- Remove & dispose 1 transfer pump, 1 T/C tree, 1 LOW, 1 slurry distributor
- Install 2 submersible mixer pumps with incremental lowering devices **[8]**, 1 variable decant depth transfer pump **[9]**, 1 variable slurry depth transfer pump **[10]**, 1 T/C tree

AW-104 Feed Delivery System – *FY 2018 Start*
- Remove & dispose 1 transfer pump, 1 T/C tree, 1 LOW, 1 saltwell casing, 1 corrosion probe, 1 slurry distributor
- Install 2 submersible mixer pumps **[11]**, 1 variable decant depth transfer pump **[12]**, 1 fixed full depth transfer pump **[13]**, 1 T/C tree

AW-105 Feed Delivery System – *FY 2015 Start*
- Remove & dispose 1 transfer pump, 1 T/C tree, 1 slurry distributor
- Install 2 submersible mixer pumps with incremental lowering devices **[14]**, 1 variable decant depth transfer pump **[15]**, 1 variable slurry depth transfer pump **[16]**, 1 T/C tree

AW-106 Feed Delivery System – *FY 2021 Start*
- Remove & dispose 1 transfer pump, 1 T/C tree, 1 slurry distributor
- Install 1 submersible mixer pump **[17]**, 1 fixed full depth transfer pump **[18]**, 1 T/C tree

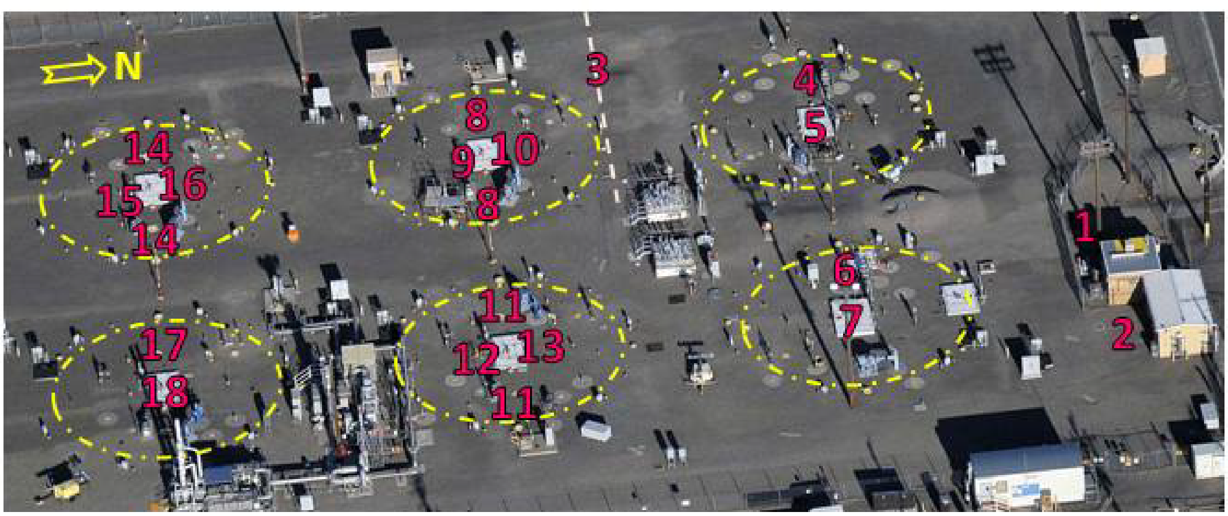
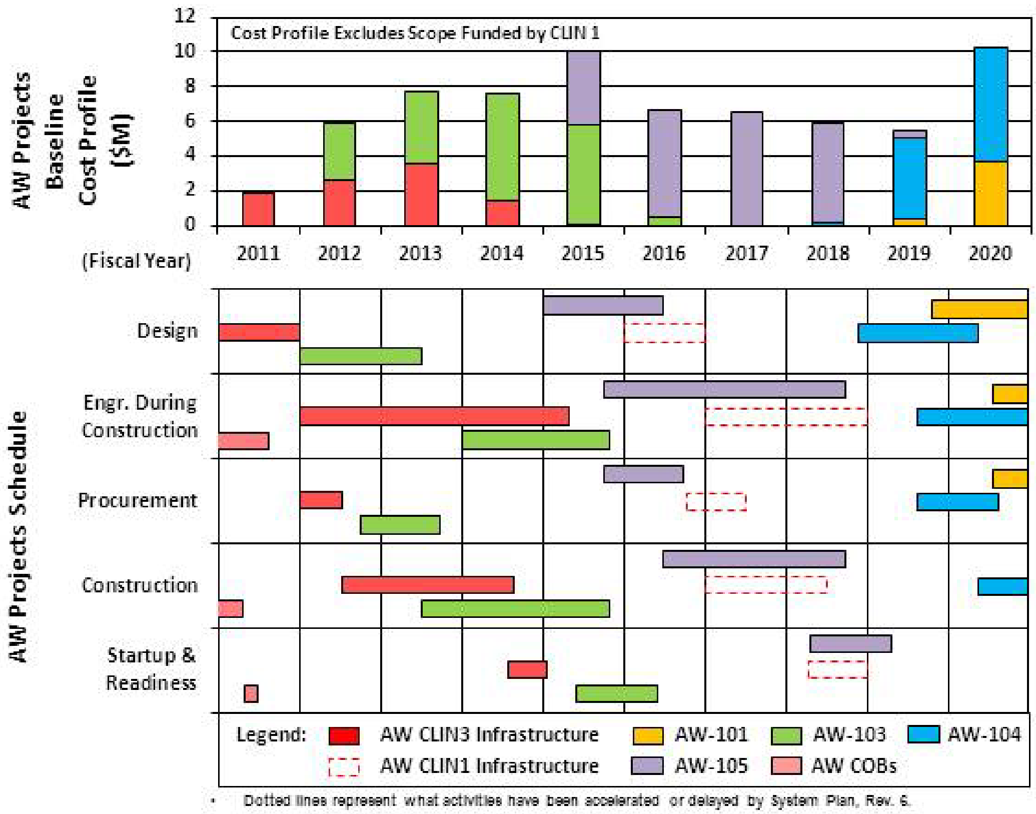


Figure 6-4. Integrated Waste Feed Delivery Project AW Farm Upgrades (2 pages)

IWFD PROJECT AW FARM UPGRADES
"10-YEAR" BASELINE



APPROACH:

Construction on a farm basis integrated with outages, CM, & DST Life Extension. AW Farm Infrastructure first followed by AW-103, AW-105, AW-104, & AW-101. Standardized pump designs installed shortly before need date. Turnover by sub-project preferred; partial turnover on as-requested basis.

MAJOR DELIVERABLES MILESTONES:

- Final designs
- Receipt of equipment procurements
- Construction completion documents
- Confirmation of readiness for feed delivery

KEY DEVELOPMENT SUPPORT AREAS:

- Mixer pump scale testing
- Sampling methodology development
- AY-102 Technology Maturation Mixing/Sampling Demonstration

Figure 6-4. Integrated Waste Feed Delivery Project AW Farm Upgrades (2 pages)

IWFD PROJECT AY/AZ FARM UPGRADES
LIFE-CYCLE SCOPE

SUMMARY SCOPE:

AY/AZ Farms Infrastructure *(FY 2010 Start)* & Ancillary Systems
- Electrical capacity upgrade **[1]** and Instrument/Control/Electrical Building upgrade *(funded in CLIN 1)*
- Utilities to tanks *(funded in CLIN 1)*
- Diluent/Flush system *(funded in CLIN 1)*

New 702-AZ condensate drain line to AZ-101 with jumper modification *[complete]*

AY/AZ Farms Primary Ventilation System Upgrade **[14]**, – *(BCR needed per direction in ORP correspondence 11-AMD-054, dated March 1, 2011 for DST VTP SS Upgrades)*
- Cooling towers with chillers
- Two skid mounted dual train units
- Vent Train spare chillers
- Air Inlet Stations

AY-101 Feed Delivery System – *(BCR needed to realign FY 2016 to FY 2013 Start)*
- Remove & dispose 3 transfer pumps, 4 T/C trees, 3 dry well T/Cs, 1 steam coil
- Install 2 submersible mixer pumps with incremental lowering devices **[2]**, 1 variable decant depth transfer pump **[3]**, 1 variable slurry depth transfer pump **[4]**, 7 T/C trees, 7 dry well stiffeners

AY-102 Feed Delivery System – *FY 2011 Start*
- Remove & dispose 1 transfer pump, 4 T/C trees, 3 dry well T/Cs, 1 MIT, 1 corrosion probe, 1 steam coil
- Install 2 submersible mixer pumps **[5]**, 1 variable decant depth transfer pump **[6]**, 1 fixed full depth transfer pump **[7]**, 7 T/C trees, 7 dry well stiffeners

AZ-101 Feed Delivery System – *FY 2013 Start*
- Remove & dispose 2 mixer pumps, 2 transfer pumps, 5 T/C trees, 1 steam coil, 3 ultrasonic probes
- Install 2 submersible mixer pumps with incremental lowering devices **[8]**, 1 variable decant depth transfer pump **[9]**, 1 variable slurry depth transfer pump **[10]**, 7 T/C trees, 6 dry well stiffeners

AZ-102 Feed Delivery System – *(BCR needed to realign FY 2014 to FY 2018 Start)*
- Remove & dispose 1 transfer pump, 4 T/C trees, 3 dry well T/Cs, 1 steam coil
- Install 2 submersible mixer pumps **[11]**, 1 variable decant depth transfer pump **[12]**, 1 fixed full depth transfer pump **[13]**, 7 T/C trees, 7 dry well stiffeners

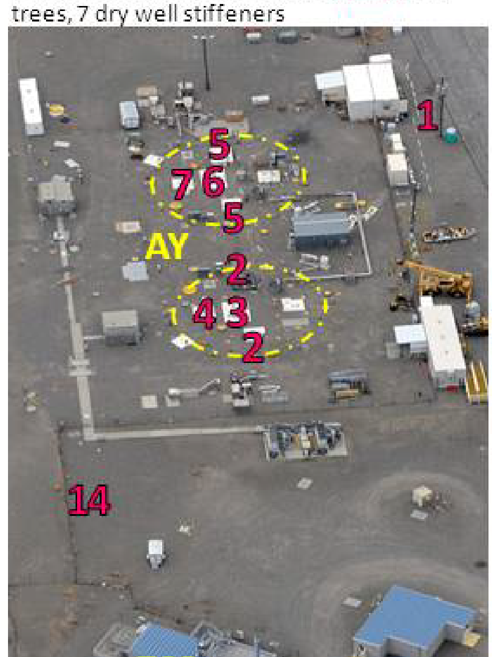
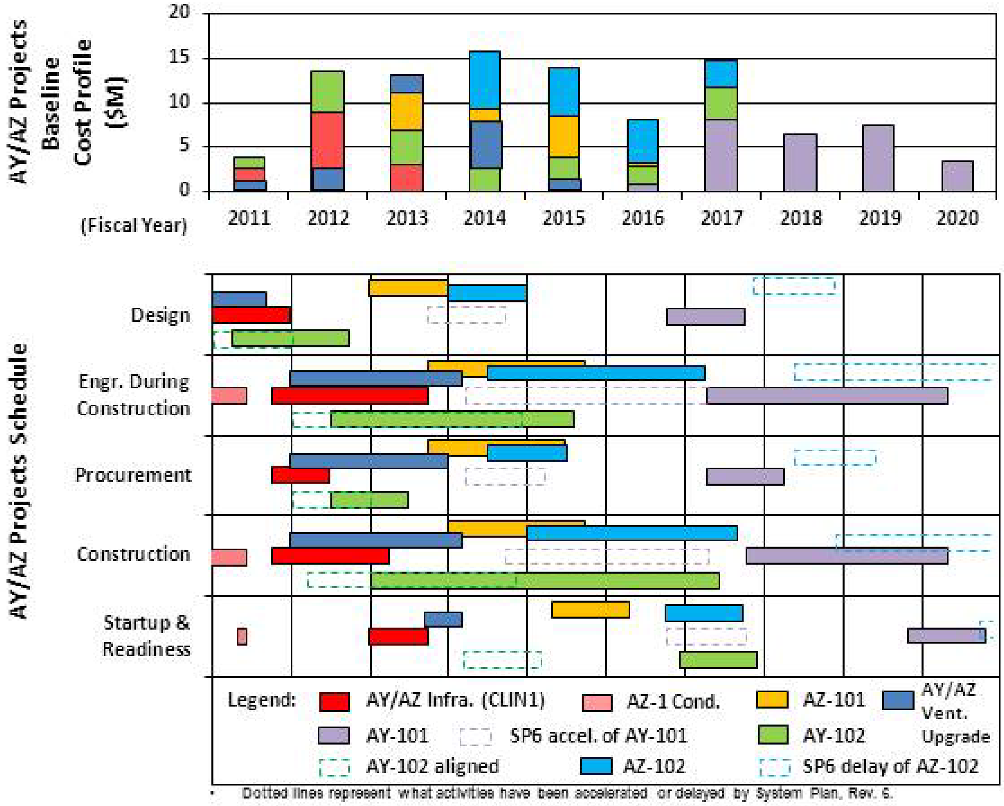


Figure 6-5. Integrated Waste Feed Delivery Project AY/AZ Farm Upgrades (2 pages)

IWFD PROJECT AY/AZ FARM UPGRADES
"10-YEAR" BASELINE



APPROACH:

Construction on a farm basis integrated with outages, CM, & DST Life Extension. AZ-1 Condensate Drain Line first followed by AY/AZ Farms CLIN 1 funded Infrastructure, 702-AZ Ventilation System upgrade, AY-102, AZ-101, AZ-102, & AY-101. AY-102 Mixing/Sampling Demonstration test results will integrate into AZ-101 & AZ-102 feed delivery systems. Standardized pump designs installed shortly before need date. Turnover by sub-project preferred; partial turnover on as-requested basis.

MAJOR DELIVERABLES MILESTONES:

- Final designs
- Receipt of equipment procurements
- Construction completion documents
- Confirmation of readiness for AY-102 testing
- AY-102 testing results
- Confirmation of readiness for feed delivery

KEY DEVELOPMENT SUPPORT AREAS:

- Mixer pump scale testing
- Sampling methodology development
- AY-102 Technology Maturation Mixing/Sampling Demonstration

Figure 6-5. Integrated Waste Feed Delivery Project AY/AZ Farm Upgrades (2 pages)

IWFD PROJECT SY FARM UPGRADES
LIFE-CYCLE SCOPE

SUMMARY SCOPE:

SY Farm Infrastructure & Ancillary Systems

- Electrical capacity [1] and Instrument/Control/Electrical Building [2] upgrades *(funded in CLIN 1 FY 2010 Start)*
- Utilities to tanks and Diluent/Flush system *(FY 2013 Start)*
- Waste transfer line compliance upgrades-- ***Completed***
- Perform upgrades to activate cross-site slurry line WT-SSL-3160 *(funded in CLIN 1 FY 2015 Start)*
- Primary exhauster replacement *(funded in CLIN 1 FY 2009 Start)*
- Primary exhauster air cooler addition to support (4) SMP operation (*BCR needed to include scope with FY 2019 start)*

SY-101 Feed Delivery System – *FY 2020 Start*

- Remove & dispose 1 mixer pump, 1 transfer pump, 2 MITs, 2 velocity density temperature trees, 1 slurry distributor
- Install 1 submersible mixer pump [3], 1 fixed full depth transfer pump [4], 1 T/C tree

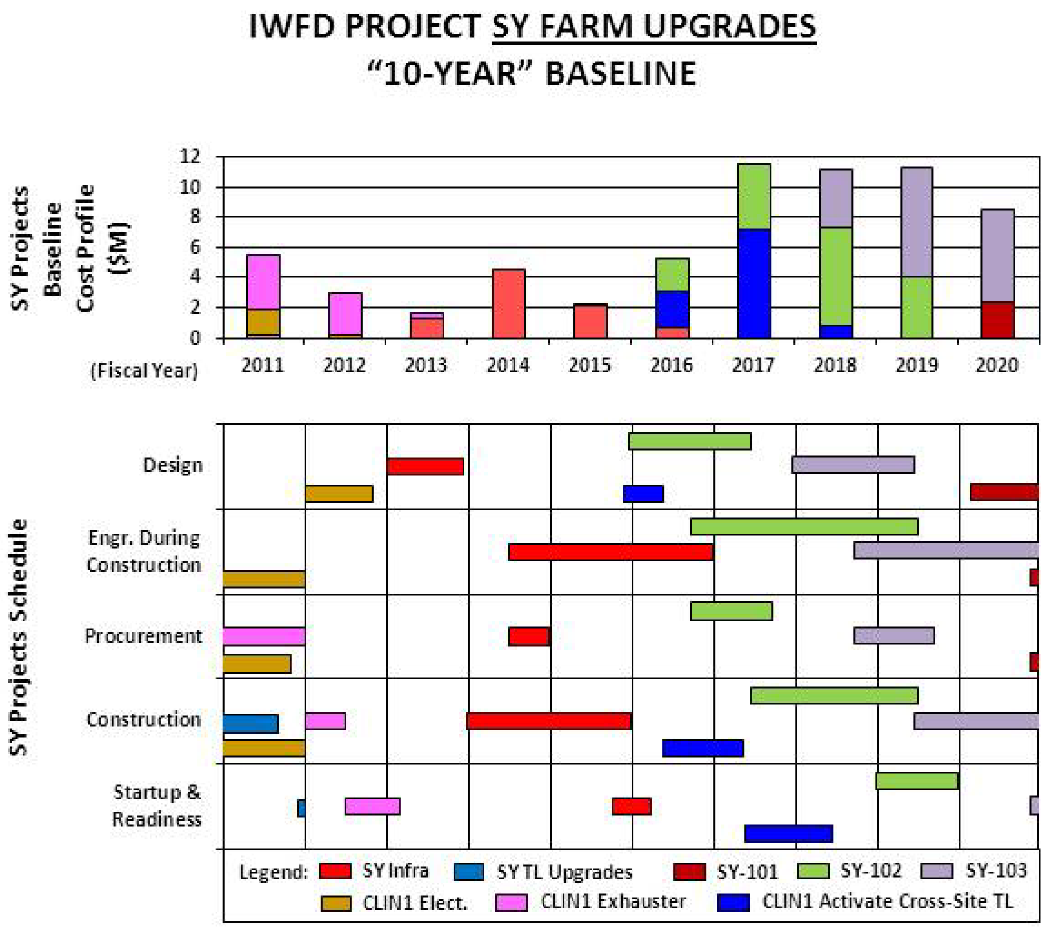
SY-102 Feed Delivery System – *(BCR needed to realign FY 2011 to FY 2016)*

- Remove & dispose 2 transfer pumps, 1 T/C tree, 1 LOW, 1 ALC, 1 slurry distributor
- Install 2 submersible mixer pumps with incremental lowering devices [5], 1 variable decant depth transfer pump [6], 1 variable slurry depth transfer pump [7], 1 T/C tree

SY-103 Feed Delivery System – *FY 2018 Start*

- Remove & dispose 1 transfer pump, 1 MIT, 1 slurry distributor, 1 camera-multiport
- Install 2 submersible mixer pumps with incremental lowering devices [8], 1 fixed full depth transfer pump [9], 1 T/C tree

Figure 6-6. Integrated Waste Feed Delivery Project SY Farm Upgrades (2 pages)



APPROACH:

Construction on a farm basis integrated with outages, CM, & DST Life Extension. SY Farm Transfer Lines first currently followed by SY Farm Infrastructure, SY-102, & SY-103. BCR needed to realign infrastructure start date from FY 2011 to FY 2013 and SY-102 start date from FY 2011 to FY 2016. Standardized pump designs installed shortly before need date. Turnover by sub-project preferred; partial turnover on as-requested basis.

MAJOR DELIVERABLES MILESTONES:

- Final designs
- Receipt of equipment procurements
- Construction completion documents
- Confirmation of readiness for feed delivery

KEY DEVELOPMENT SUPPORT AREAS:

- Mixer pump scale testing
- Sampling methodology development
- AY-102 Technology Maturation Mixing/ Sampling Demonstration

Figure 6-6. Integrated Waste Feed Delivery Project SY Farm Upgrades (2 pages)

IWFD PROJECT SUPPORT BUILDINGS UPGRADES LIFE-CYCLE SCOPE

SUMMARY SCOPE:

Centralized Control Building [1] – *FY 2015 Start*
- Permanent structure on base foundation (~8,500 sq. ft)
- Full-wall office space for 15 employees with conference room for 30 people
- Utilities included: electrical power, potable water, sanitary septic system, phone and HLAN, fire alarm
- Estimated 40 year life

Farm Work Team Offices – *FY 2015 Start (requires coordination with Facilities Planning)*
- SY Farm office site [2]
- AN/AY/AZ Farms office site [3]
- AP/AW Farms office site [4]
- Modular structures
- Full wall office space for 3 employees; workstations for up to 6

Mixer Pump Storage Building [5] – *FY 2015 Start*
- Class B warehouse storage facility, modified to accommodate small office area, restrooms, break room
- Capable of storing up to 10 pump units
- Additional ~3,000-5,000 sq. ft. rack and shelf-type spare part storage
- Aisle ways for large forklift (> 12,000 lbs.)
- Support capability for 20,000 lbs. overhead crane to span main pump storage area
- Separate climate controlled office area and restroom
- Utilities included: electrical power, potable water, sanitary septic system, phone and HLAN, fire alarm
- Estimated 40 year life

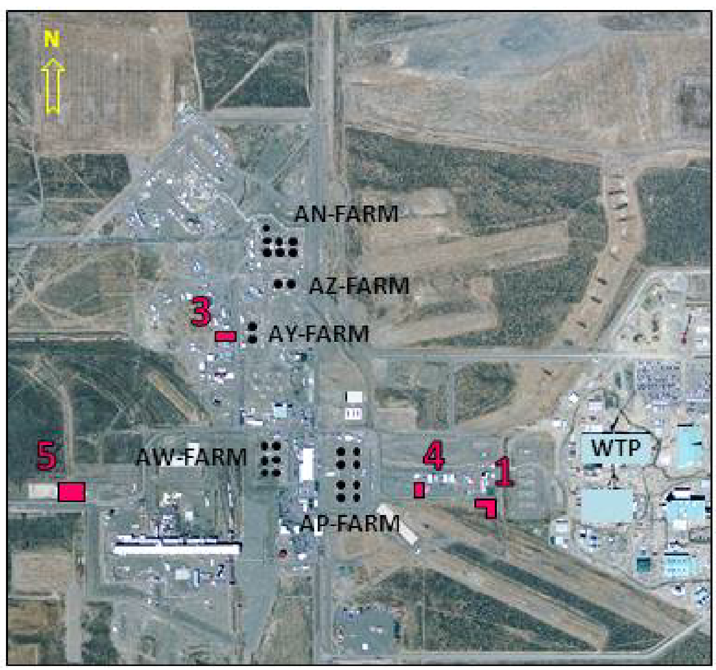
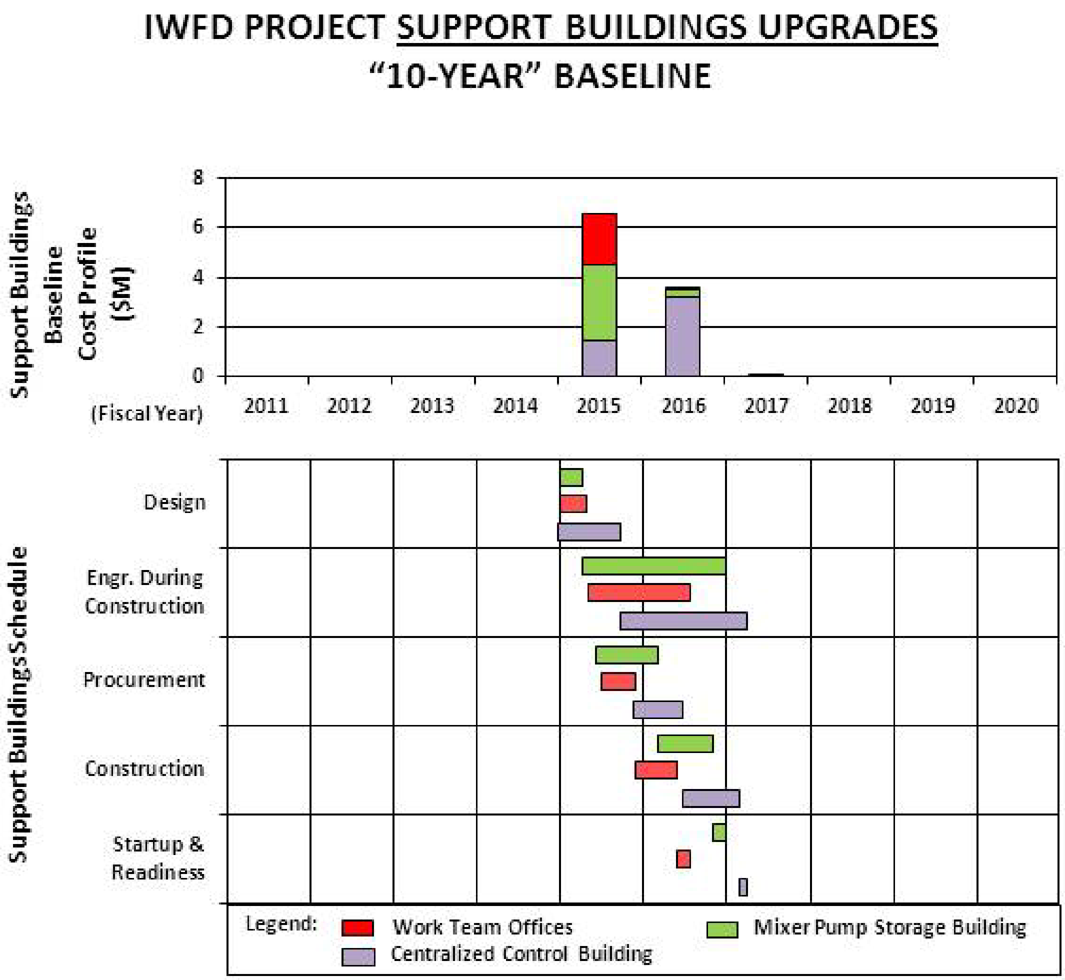


Figure 6-7. Integrated Waste Feed Delivery Project Support Buildings Upgrades (2 pages)



APPROACH:

Buildings are sub-contracted, pre-engineered structures. As they are located outside tank farm boundaries, no in-farm restrictions apply.

MAJOR DELIVERABLES MILESTONES:

- Final designs
- Receipt of equipment procurements
- Construction completion documents
- Confirmation of readiness for feed delivery

KEY DEVELOPMENT SUPPORT AREAS:

- None

Figure 6-7. Integrated Waste Feed Delivery Project Support Buildings Upgrades (2 pages)

Table 6-1. Integrated Waste Feed Delivery Projects Upgrade Scope

DST Retrieval System Matrix

✓ABC - activity complete

	Equipment Installation																Equipment Removal					
Tank Farm Facility	SMP	SMP on Riser Pad	SMP on Pit Cover Block	SMP Incremental Lowering Capability[f]	Variable Slurry Depth TP & Jumper	Fixed Full Depth TP & Jumper	Variable Decant Depth TP & Jumper	Cover Blocks	Profile T/C Tree	Dry Well Stiffener	Cert. Loop/ Sampl. Sys.	Diluent/ Flush System	ICE Bldg	Utilities to tanks	Electrical Capacity Upgrade	Other	MP	TP	Profile T/C Tree	Sludge T/C	Other LLCE	Other
AN-101	2 [i]	X		X [iii]	1 [v]		1 [vi]	1	1									1	1			slurry distributor
AN-102	2 [i]	X		X [iii]	1 [v]		1 [vi]	1	1									1	1		MPCMS[e], corrosion probe/ high level detection assy.[e]	slurry distributor
AN-103	2 [i]	X		X [iv]	1 [v]		1 [vi]	1	1									1	1		MIT	slurry distributor, camera-multiport
AN-104	2 [i]	X		X [iv]	1 [v]		1 [vi]	1	1							relocate SLL-3160 tie-in to pit 04A		1	1		MIT, IMCP[e]	slurry distributor, camera-multiport
AN-105	2 [i]	X		X [iv]	1 [v]		1 [vi]	1	1									1	1		MIT, IMCP[e]	slurry distributor, camera-multiport
AN-106	2 [i]	X		X [iii]	1 [v]		1 [vi]	1	1								1	2	1			slurry distributor
AN-107	1 [ii]		X			1 [vi]		1	1								1	1	1		(2) IMCP[e]	
AN Infrastructure & Ancillary Systems											X[c]	X	X	X	X	verify primary exhauster for (4) SMP operation						deactivated exhauster
AP-101						1 [vi]		1										1				
AP-102							1 [vi][b]	1										1				
AP-103						1 [vi]		1										1				
AP-104						1 [vi]		1										1				
AP-105	1 [ii]		X			1 [vi]		1	1									1	1			slurry distributor
AP-106						1 [vi]		1										1				
AP-107						1 [vi]		1										1				
AP-108	1 [ii]		X			1 [vi]		1	1									1	1			slurry distributor
AP Infrastructure & Ancillary Systems												X[a]	X	X	X	primary exhauster						deactivated exhauster
AW-101	1 [ii]		X	X [iv]		1 [vi]		1	1									1	1		MIT	slurry distributor
AW-102	1 [ii]		X			1 [vi]		1	1									1	1		ALC	
AW-103	2 [i]	X		X [iii]	1 [v]		1 [vi]	1	1									1	1		LOW	slurry distributor
AW-104	2 [i]	X		X [iii][d]	1 [v][d]	1 [v]	1 [vi]	1	1									1	1		LOW, saltwell casing, MPCMS[e] (planned)	slurry distributor
AW-105	2 [i]	X		X [iii]	1 [v]		1 [vi]	1	1									1	1			slurry distributor
AW-106	1 [ii]		X			1 [vi]		1	1									1	1			slurry distributor
AW Infrastructure & Ancillary Systems											X[c]	X	X	X	X	verify primary exhauster for (4) SMP operation						✓(3) COB, SHMS, GCS, deactivated exhauster
AY-101	2 [i]		X	X [iii]	1 [v]		1 [vi]	2	7	7						pit 01C-to-01A transfer line		3	4	3	steam coil	
AY-102	2 [i]		X	X [iii][d]	1 [v][d]	1 [v]	1 [vi]	2	7	7						pit 02C-to-02A transfer line		3	4	3	steam coil, MIT, MPCMS[e]	
AZ-101	2 [i]	X		X [iii]	1 [v]		1 [vi]	2	7	6						pit 01B-to-01A transfer line	2	2	5		steam coil, (3) ultrasonics probe	
AZ-102	2 [i]	X		X [iii]	1 [v]		1 [vi]	2	7	7						pit 02B-to-02A transfer line		1	4	3	steam coil	
AY/AZ Infrastructure & Ancillary Systems											X[c]	X	X	X	X	AZ-1 condensate line, 702-AZ vent sys upgrade for (4) SMP operation, CTF upgrade, 200-E elect. utilitiy upgrade						
SY-101	1 [ii]		X			1 [vi]		1	1								1	1			(2) MIT, (2) VDTT	slurry distributor
SY-102	2 [i]	X		X [iii]	1 [v]		1 [vi]	1	1									2	1		LOW, ALC	slurry distributor
SY-103	2 [i]	X		X [iv]	1 [v]		1 [vi]	1	1									1			MIT	slurry distributor, camera-multiport
SY Infrastructure & Ancillary Systems												X	X	X	X	primary exhauster for (4) SMP operation, in-farm transfer lines, activate cross site slurry line						✓(5) SHMS, (2) GMS, pre-fabricated pump pit, deactivated exhauster

Notes:

[a] Shared system with AW Farm Diluent/Flush System.
[b] TP located in 02D pit.
[c] Cert. Loop/Sampl. Sys. deployment by tank or by farm is TBD.
[d] Installed later in mission > FY2025. Fixed full depth TP replaced by variable slurry depth TP when ILD installed.
[e] Structural enhancement implemented, as required.
[f] Use of incremental lowering in AY- and AZ-Farm DSTs may exacerbate issues with fat

Planned Function:

[i] = sludge mixing
[ii] = assist saltcake dissolution
[iii] = deep sludge > 70 in.
[iv] = initial deep saltcake > 100 in.
[v] = HLW slurry transfer; concurrent with SMP operation
[vi] = LAW supernatant transfer

Key:

ALC = air lift circulator
COB = clean out box
CTF = Cold Test Facility
ICE = instrument/control/electrical
GCS = gas characterization system
GMS = gas monitoring system
ILD = incremental lowering device
IMCP = integrated multi-function corrosion probe
LLCE = long length contaminated equipment
LOW = liquid observation well
MIT = multi-function instrument tree
MP = mixer pump
MPCMS = multi-probe corrosion monitoring system
SHMS = standard hydrogen monitoring system
SMP = submersible mixer pump
T/C = thermocouple
TP = transfer pump
VDTT = velocity density temperature tree

T6-1 ver. 8/17/10

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7.0 PERFORMANCE MEASUREMENT BASELINE

The PMB is the time-phased budget plan against which the IWFD projects performance is measured. The PMB does not include management reserve. It includes all allocated or distributed budgets plus any undistributed budget.

The PMB is formed by the budgets assigned to the scheduled control accounts, resulting in the project's budgeted cost for work scheduled (BCWS) profile. The BCWS is established for work packages and planning packages and is summed to the control account level. Further BCWS summarizations are made through the WBS and organizational levels. At each level, from the detailed work package to the total contract, BCWS reflects the performance plan (in dollars) against which work accomplished can be measured. This BCWS or PMB becomes the key earned value component for comparison of work accomplished with work scheduled, and the actual cost with the value of the work performed. The PMB represents the formal plan for each control account manager (CAM) to accomplish their assigned control account(s) on schedule and within budget.

7.1 PROJECT BASELINE

The baseline defines the project's key technical, schedule, cost, and performance parameters and provides the means to measure progress and assess performance. The baseline is composed of three elements: scope, schedule, and cost. These three elements are integrated into the project life-cycle schedule. It is periodically updated to reflect approved changes and expanded in detail to reflect the tasks scheduled in the current phase of the project.

7.2 WORK BREAKDOWN STRUCTURE

The WBS is a product-oriented integration tool used to graphically organize projects and segmented tasks for definition of scope requirements, planning, budgeting, estimating, scheduling, work authorization, cost accumulation, and performance/progress reporting purposes. The WBS variances will be addressed through project management.

The WBS is developed as a hierarchical (tiered), product-oriented structure to organize, define, and display the TOC work to be performed. It also allows consistent roll-up of performance measurement data in the field, and both subcontractor and PMB schedules. Each descending level or subdivision of the WBS is developed as an increasingly detailed definition of the work component (product or service).

Figure 7-1 illustrates the project's Level 5WBS, which is used to estimate and schedule the work activities. The WBS structure shows the relationship of each WBS element to the others and the project as a whole. This level of WBS elements is captured in the project schedule and assigned to IPT members. In this manner, the project schedule also serves as the responsibility assignment matrix for the project. The TOC life-cycle WBS structure is maintained in the HANDI-PERF IPARS[15] control (HPIC) module and is maintained under configuration control by the HPIC system administrator.

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[15] HANDI = Hanford data integrator, PERF = performance module, IPARS = integrated planning and reporting system.

Integrated Waste Feed Delivery Projects (EOM March FY11 Baseline)

Activity ID	BL1 Start	BL1 Finish	At Completion Total Cost
5 River Protection Project	01-Oct-08	29-Sep-45	$660,099,839.67
5.03 WFD/Treatment Plng/DST Retrieval/Closure	01-Oct-08	29-Sep-45	$660,099,839.67
5.03.02 Construct DST Systems	01-Oct-08	29-Sep-45	$660,099,839.67
5.03.02.04 RA - DST Feed Delivery Project	06-Jul-09	30-Sep-11	$6,016,490.78
5.03.02.04.01 RA - DST Feed Delivery Project Mgmt	06-Jul-09	30-Sep-11	$2,873,935.97
5.03.02.04.02 RA - DST Feed Delivery Project Support	06-Jul-09	19-Jul-11	$2,233,694.51
5.03.02.04.03 RA - DST Feed Delivery Safety Analysis	01-Sep-10	04-Mar-11	$438,580.04
5.03.02.04.04 RA - DST Feed Delivery Environmental/Permitting	05-Jan-10	02-Jun-11	$470,280.26
5.03.02.06 DST Feed Delivery Projects	01-Oct-08	29-Sep-45	$129,198,093.11
5.03.02.06.01 DST Feed Delivery Project Management	01-Oct-08	29-Sep-45	$44,128,828.90
5.03.02.06.02 DST Feed Delivery Project Support	04-Apr-11	30-Jul-31	$65,639,633.61
5.03.02.06.03 DST Feed Delivery Safety Analysis	01-Feb-11	31-Jul-15	$959,709.28
5.03.02.06.04 DST Feed Delivery Environmental/Permitting	30-Nov-12	30-Dec-13	$430,875.00
5.03.02.06.05 AY-102 Tech Maturation Mixin/Sampling Demonstrat	03-Jan-11	11-Sep-18	$18,039,046.32
5.03.02.07 AN Farm Feed Delivery Systems	01-Apr-13	24-Sep-27	$115,421,127.91
5.03.02.07.01 AN-101 Feed Delivery System	01-May-17	31-Dec-20	$7,994,179.45
5.03.02.07.02 AN-102 Feed Delivery System	03-Jan-22	04-Feb-26	$16,316,253.27
5.03.02.07.03 AN-103 Feed Delivery System	01-May-18	24-Oct-22	$19,442,415.84
5.03.02.07.04 AN-104 Feed Delivery System	01-Apr-15	24-Sep-19	$19,255,334.74
5.03.02.07.05 AN-105 Feed Delivery System	03-Apr-23	24-Sep-27	$19,255,334.74
5.03.02.07.06 AN-106 Feed Delivery System	01-Apr-13	25-Jul-17	$18,929,002.26
5.03.02.07.07 AN-107 Feed Delivery System	01-May-20	01-Feb-24	$14,228,607.61
5.03.02.08 AP Farm Feed Delivery Systems	01-Oct-12	24-Jan-30	$107,901,761.34
5.03.02.08.01 AP-101 Feed Delivery System	01-Jun-17	28-Apr-20	$11,843,906.45
5.03.02.08.02 AP-102 Feed Delivery System	03-Oct-22	28-Aug-25	$10,804,432.77
5.03.02.08.03 AP-103 Feed Delivery System	02-Mar-26	25-Jan-29	$12,235,663.76
5.03.02.08.04 AP-104 Feed Delivery System	03-Sep-24	30-Jul-27	$9,979,271.08
5.03.02.08.05 AP-105 Feed Delivery System	01-Dec-22	30-Jul-26	$13,121,101.83
5.03.02.08.06 AP-106 Feed Delivery System	01-Sep-26	30-Jul-29	$12,235,663.76
5.03.02.08.07 AP-107 Feed Delivery System	01-Mar-27	24-Jan-30	$12,235,766.26
5.03.02.08.08 AP-108 Feed Delivery System	02-Jan-18	26-Aug-21	$13,127,195.32

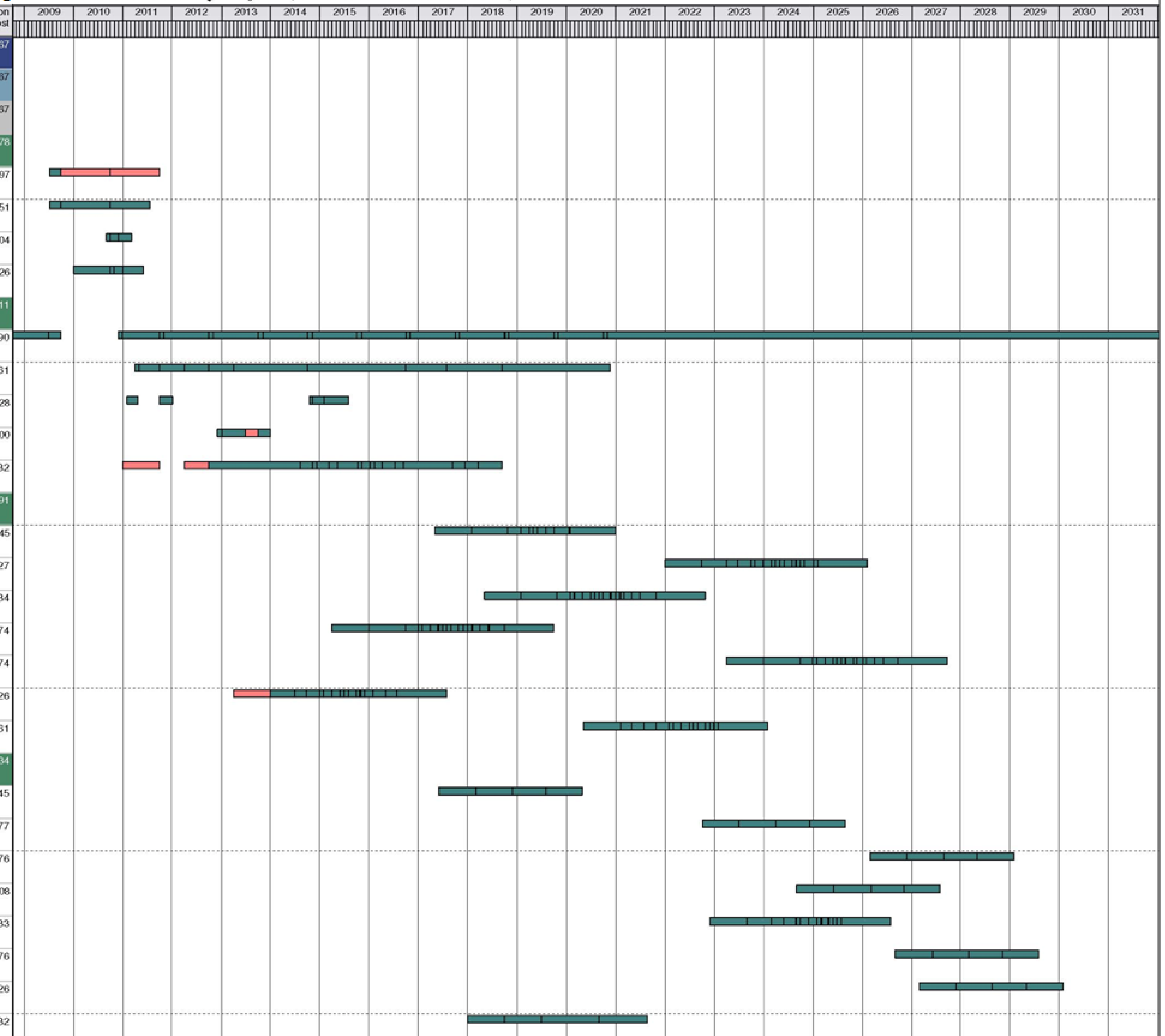

Figure 7-1. Integrated Waste Feed Delivery Project Work Breakdown Structure, Scope, Budget, and Schedule (2 pages)

Integrated Waste Feed Delivery Projects (EOM March FY11 Baseline)

Activity ID	BL1 Start	BL1 Finish	At Completion Total Cost
5.03.02.08.09 AP Farm Infrastructure	01-Oct-12	09-Nov-15	$12,318,760.10
5.03.02.09 AW Farm Feed Delivery Systems	06-Jul-09	30-Jul-31	$107,342,778.36
5.03.02.09.01 AW-101 Feed Delivery System	01-Aug-19	29-Jan-24	$14,847,887.57
5.03.02.09.02 AW-102 Feed Delivery System	01-Dec-27	30-Jul-31	$13,417,764.74
5.03.02.09.03 AW-103 Feed Delivery System	03-Oct-11	29-Feb-16	$17,956,465.67
5.03.02.09.04 AW-104 Feed Delivery System	04-Sep-18	06-Sep-22	$18,341,332.37
5.03.02.09.05 AW-105 Feed Delivery System	01-Oct-14	25-Jan-19	$19,882,698.71
5.03.02.09.06 AW-106 Feed Delivery System	01-Jun-21	29-Jan-25	$13,201,421.73
5.03.02.09.07 RA - AW Farm Infrastructure	06-Jul-09	30-Sep-11	$2,130,481.55
5.03.02.09.08 AW Farm Infrastructure	03-Oct-11	28-Jan-15	$7,564,726.02
5.03.02.10 AY Farm Feed Delivery Systems	01-Aug-16	21-Aug-20	$21,894,404.84
5.03.02.10.01 AY-101 Feed Delivery System	01-Aug-16	21-Aug-20	$21,894,404.84
5.03.02.11 AZ Farm Feed Delivery Systems	01-Oct-12	30-Jun-17	$31,779,680.26
5.03.02.11.01 AZ-101 Feed Delivery System	01-Oct-12	25-Jan-16	$14,446,821.20
5.03.02.11.02 AZ-102 Feed Delivery System	01-Oct-13	30-Jun-17	$17,332,859.06
5.03.02.12 SY Farm Feed Delivery Systems	04-Apr-11	02-Aug-23	$57,627,024.60
5.03.02.12.01 SY-101 Feed Delivery System	02-Dec-19	02-Aug-23	$14,133,197.02
5.03.02.12.02 SY-102 Feed Delivery System	04-Apr-11	23-Nov-20	$16,271,597.27
5.03.02.12.03 SY-103 Feed Delivery System	02-Oct-17	31-Aug-21	$19,351,537.88
5.03.02.12.04 SY Farm Infrastructure	01-Oct-12	28-Sep-16	$7,870,692.42
5.03.02.13 Pumps and Support Equipment	06-Jul-09	14-Sep-28	$43,883,568.62
5.03.02.13.01 Existing Transfer and Mixer Pump Refurb	01-Jun-12	02-Jan-14	$612,287.20
5.03.02.13.02 RA - Relocatable Mixer Pumps	06-Jul-09	31-May-11	$1,281,538.22
5.03.02.13.03 Mixer Pump Relocation Equipment	01-Aug-13	26-Nov-14	$1,540,334.60
5.03.02.13.04 Mixer Pump Incremental Lowering Devices Des	03-Oct-11	30-Aug-13	$535,334.60
5.03.02.13.07 Mixer Pump Procurement	03-Oct-11	14-Sep-28	$39,914,074.00
5.03.02.14 Support Building	01-Oct-14	04-Jan-17	$9,713,398.40
5.03.02.14.01 Centralized Control Building	01-Oct-14	04-Jan-17	$4,215,977.60
5.03.02.14.02 Mixer Pump Storage Building	01-Oct-14	27-Sep-16	$3,547,210.40
5.03.02.14.03 Work Team Offices	01-Oct-14	27-Apr-16	$1,950,210.40
5.03.02.15 AY/AZ Ventilation System Upgrade	26-Jan-11	25-Sep-14	$25,667,631.98
5.03.02.15.01 AY/AZ Ventilation System Upgrade	26-Jan-11	25-Sep-14	$25,667,631.98
5.03.02.16 RA - Waste Feed EPCC - Strategic Plan	26-May-09	21-Feb-14	$2,439,153.88
5.03.02.16.01 RA - Waste Feed EPCC - Strategic Plan	26-May-09	30-Sep-11	$2,199,305.73
5.03.02.16.02 Operations Research (OR) Model	22-Jul-13	21-Feb-14	$239,848.15
5.03.02.17 RA - AW & SY D&D (SHMS - GCS)	13-Jul-09	31-May-11	$1,214,725.60

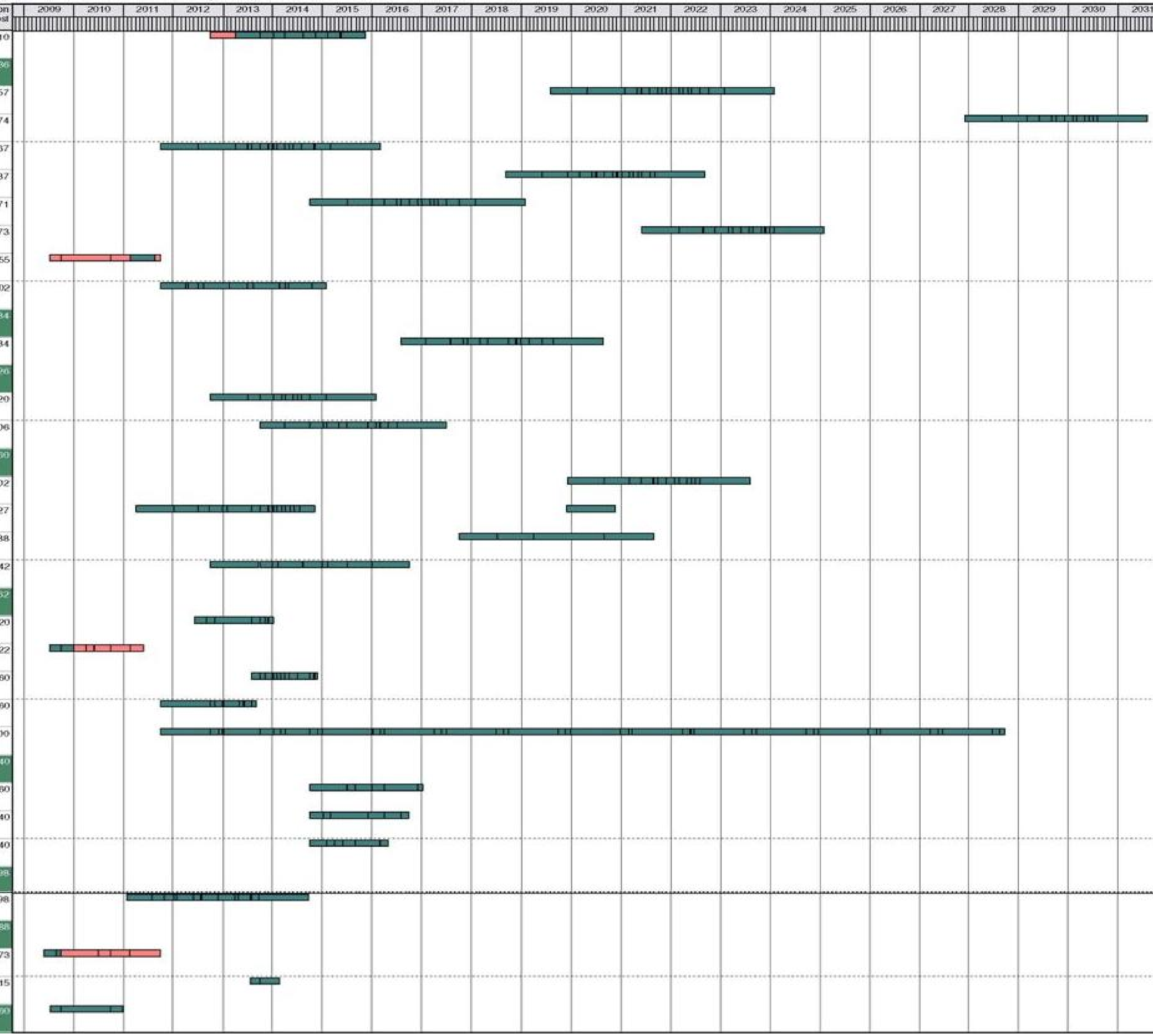

Figure 7-1. Integrated Waste Feed Delivery Project Work Breakdown Structure, Scope, Budget, and Schedule (2 pages)

7.3 SCOPE BASELINE

The project executes the scope baseline defined from the technical baseline documentation and the identified project workscope. The technical baseline for the project is defined through the collective specifications and requirements referenced within this project plan. From this technical baseline documentation, the project scope is defined and the scope baseline established. It is from this definition that the WBS and activities are derived.

7.4 SCHEDULE BASELINE

The baseline schedule for this project plan is shown in Figure 7-1. The schedule was developed based on TFC-PRJ-PC-D-04.6, *Scheduler's Guidance*, and is documented and maintained in the current TOC baseline. The project baseline schedule is maintained in Primavera P6,[16] which facilitates project planning and identification of time phasing and logic relationships and determines critical project activities and performance assessments. It specifies the time required to complete the workscope elements, reach project milestones, and complete the project. The schedule baseline will be updated periodically to reflect changes to the project. As appropriate, the scheduled activities will be executed to minimize weather impacts.

7.5 CRITICAL PATH SCHEDULE

Figure 7-2 is based on the current PMB schedule for FY 2012. The critical path schedule shows the IWFD projects that are currently in the schedule. The schedule provides a basis to measure progress of IWFD system deployment and the need to ensure that upgrades within this IWFDP do not impact the WTP critical path for hot commissioning.

7.5.1 Waste Feed Delivery Projects Alignment with System Plan Tank Sequence

The TOC EPCC projects planned to implement the feed systems required for WFD to the WTP are defined jointly between the CLIN 1 tank farms upgrades and the CLIN 3 WTP feed delivery program. The individual project baselines require alignment with the DST configuration sequence modeled in the System Plan (Rev. 6). This is also addressed in IWFDP Volume 2 for the first eight campaigns that are projected for the near-term. Project integration activities have identified certain inconsistencies in the current alignment. Proposed corrections to the identified project baselines to realign the CLIN 1 and CLIN 3 EPCC projects, as presented in Figure 7-3, are in progress. The proposed corrections are also addressed in Section 6.0, Figure 6-2 through Figure 6-7.

7.6 COST BASELINE

Figure 7-1 (Section 7.2) also provides a summary of the cost baseline for this project plan. The cost estimate was developed in accordance with TFC-PRJ-PC-C-05, *Estimating*, and the estimate baseline is documented and maintained in the current RPP baseline.

[16] Primavera is a registered trademark and P6 is a trademark of Oracle Corporation, Redwood Shores, California.

INTEGRATED WASTE FEED DELIVERY PROJECTS to WTP CRITICAL PATH ANALYSIS as of 10/03/2011

Activity ID	WCRD6-...	WCRD4-GBL	Activity Name	OD	Proposed Start	Proposed Finish
AY-102				1846	22-Nov-10 A	27-Apr-18
WFO Feed Delivery HLW Tank Mix and Sample				276	24-Mar-17	27-Apr-18
PDSA				189	04-Jan-12	28-Sep-12
DSA Revision				126	01-Oct-12	02-Apr-13
AY-102 Mixing Demonstration Design				379	22-Nov-10 A	29-Jun-12
AY-102 Procurement				251	01-Oct-12	27-Sep-13
AY-102 Construction				468	01-Oct-12	08-Aug-14
AY-102 Startup and Readiness				252	23-Sep-14	22-Sep-15
Critical Path				252	23-Sep-14	22-Sep-15
JJA-655010	CP	AY-102	AY-102 Start-up & Readiness	252	23-Sep-14	22-Sep-15
AY-102 Mixing Demonstration and Results Analysis				128	23-Sep-15	28-Mar-16
Critical Path				128	23-Sep-15	28-Mar-16
JJA-655020	CP	AY-102	AY-102 Mixing Demonstration Test	64	23-Sep-15	23-Dec-15
JJA-656010	CP	AY-102	AY-102 Mixing Demonstration Results & Analysis	64	28-Dec-15	28-Mar-16
AY-102 Reconfiguration for WFD Mission				125	23-Sep-16	24-Mar-17
Critical Path				125	23-Sep-16	24-Mar-17
JJA-657010	CP	AY-102	AY-102 Reconfiguration for WFD Mission	125	23-Sep-16	24-Mar-17
AY/AZ Infrastructure				1196	14-Jun-10 A	01-Apr-15
AY / AZ Farm Infrastructure Upgrades				64	01-May-11 A	28-Nov-11
AY/AZ Infrastructure Construction				687	29-Nov-11	19-Aug-14
AY/AZ Infrastructure Startup & Readiness				154	20-Aug-14	01-Apr-15
RA - AY/AZ Farm Infrastructure Prelim Design				64	14-Jun-10 A	30-Sep-10 A
RA - AY/AZ Farm Infrastructure Design				260	01-Oct-10 A	15-Sep-11 A
AY/AZ Vent				1175	29-Nov-10 A	22-Sep-15
AY/AZ Vent Upgrade Design				425	29-Nov-10 A	28-Sep-12
AY/AZ Vent Upgrade Construction				610	22-Jan-13	22-Jun-15
AY/AZ Vent Upgrade Startup & Readiness				252	23-Sep-14	22-Sep-15
Critical Path				252	23-Sep-14	22-Sep-15
JJA-515010	CP	AY/AZ-V	AY/AZ Ventilation System Upgrade Start-up & Readiness	252	23-Sep-14	22-Sep-15
Full-Scale Mixer Demo				1590	03-Oct-11	25-Jan-18
Integrated Optimization				168	03-Oct-11	01-Jun-12
Small Scale Integration				149	04-Jun-12	07-Jan-13
Full Scale Demonstration				937	08-Jan-13	22-Sep-16
Critical Path				937	08-Jan-13	22-Sep-16
JAA-835010	CP	Mix	Full Scale Demonstration Plan Development	104	08-Jan-13	04-Jun-13
JAA-835015	CP	Mix	Full Scale Test Instrument Specification	85	02-May-13	30-Aug-13
JAA-835020	CP	Mix	Full Scale Test Instrument Procurement	125	01-Oct-13*	01-Apr-14
JAA-835030	CP	Mix	Full Scale Test Equipment Installation	126	02-Apr-14	29-Sep-14
JAA-835040	CP	Mix	Full Scale Test Readiness	42	24-Jul-15	22-Sep-15
JAA-835050	CP	Mix	Full Scale Test Engineer and Data Collection	126	23-Sep-15	24-Mar-16
JAA-835060	CP	Mix	Full Scale Test Sample Collection and Analysis	126	23-Sep-15	24-Mar-16
JAA-835070	CP	Mix	Full Scale Test Operations	126	23-Sep-15	24-Mar-16
JAA-835080	CP	Mix	Full Scale Test Data Evaluation	85	25-Mar-16	25-Jul-16
JAA-835090	CP	Mix	Full Scale Test Optimization Review	42	26-Jul-16	22-Sep-16
WFD Mission Application				336	23-Sep-16	25-Jan-18
Critical Path				336	23-Sep-16	25-Jan-18
JAA-836010	CP	Mix	Lifecycle Feed Staging Evaluation	83	23-Sep-16	24-Jan-17
JAA-836020	CP	Mix	Mission Demonstration Plan Development	42	25-Jan-17	24-Mar-17
JAA-836030	CP	Mix	Mission Small Scale Demonstration	211	27-Mar-17	25-Jan-18
Mixer Pumps				903	11-May-09 A	31-Dec-12
RA - Small Scale Demonstration				547	11-May-09 A	29-Sep-11 A
RA - Mixer Pump Specification Design				124	06-Jul-09 A	22-Dec-09 A
RA - Mixer Pump Procurement				252	21-May-10 A	30-Sep-11 A
Mixer Pump Procurement				313	03-Oct-11	31-Dec-12
WTP Commissioning				124	01-May-18	24-Oct-18
WFO Feed Delivery LAW Tank Mix and Sample				0	03-May-18	03-May-18
Critical Path				0	03-May-18	03-May-18
JAM-426200	CP	WTP	LAW - Batch #1	0		03-May-18*
WFO Feed Delivery HLW Tank Mix and Sample				101	08-May-18	28-Sep-18
Critical Path				101	08-May-18	28-Sep-18
JAM-429200	CP	WTP	HLW - Batch #1	0		08-May-18*
JAA-290000	CP	WTP	HLW Mix/Transfer	101	08-May-18*	28-Sep-18
WTP Hot Commission Performance Testing Oversight				124	01-May-18	24-Oct-18
Critical Path				124	01-May-18	24-Oct-18
LFM-181015	CP	WTP	WTP Hot Commissioning Initiated	0	01-May-18	
LFA-181010	CP	WTP	Hot Commissioning Testing Oversight	124	01-May-18	24-Oct-18
C-A-17	CP	WTP	Hot Start of WTP	0		24-Oct-18*

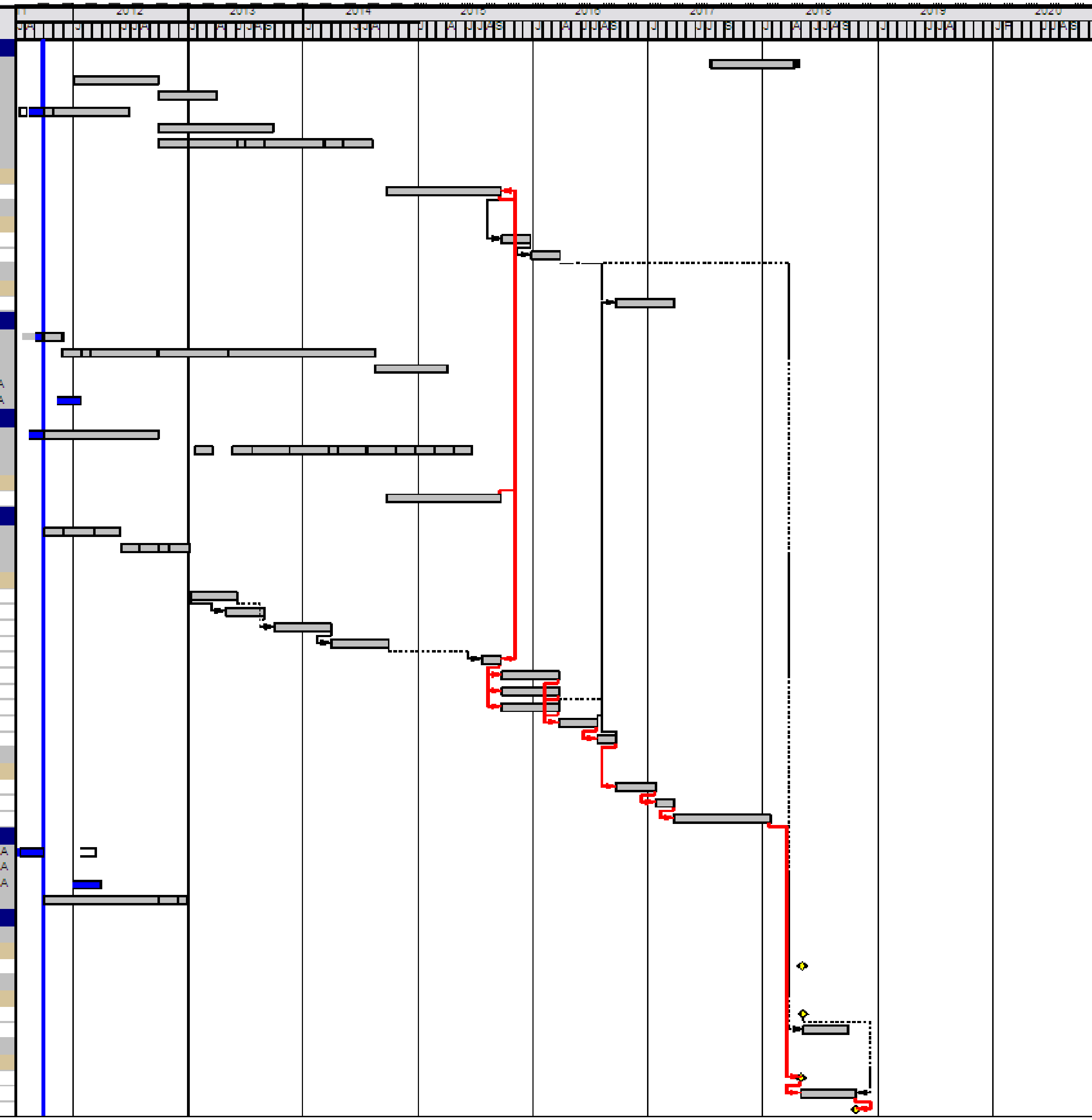

Figure 7-2. Integrated Waste Feed Delivery Projects Critical Path Schedule

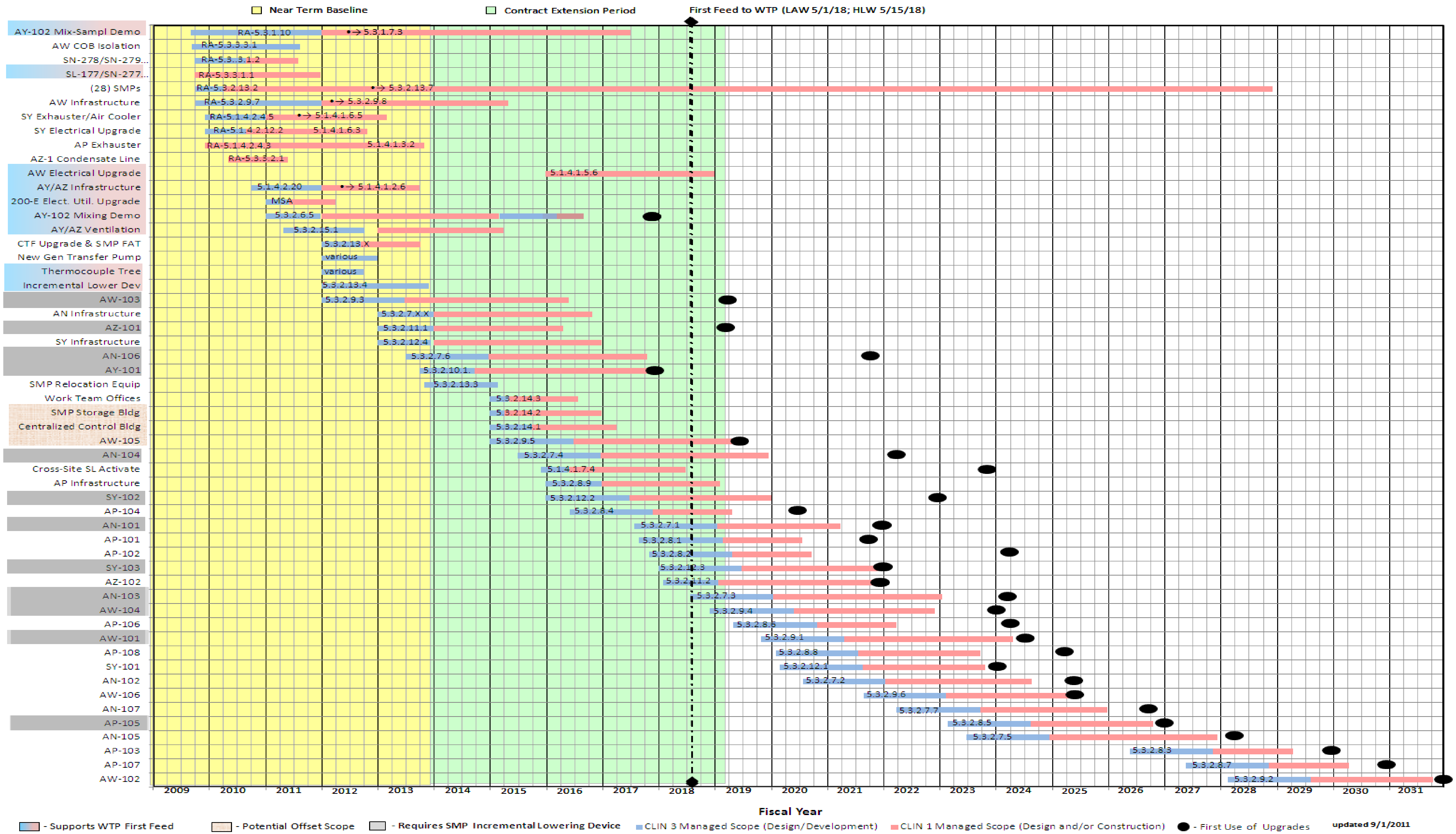

Figure 7-3. Integrated Waste Feed Delivery Projects Alignment with System Plan (Rev. 6)

8.0 ORGANIZATION AND RESPONSIBILITIES

WRPS receives contract direction from ORP. Consistent with DOE O 413.3B, the ORP WFD IPT, organized and led by the ORP WFD Federal Project Director, will participate in all phases of the project life-cycle. The ORP WFD IPT consists of professionals representing diverse disciplines with the specific knowledge, skills, and abilities to support the successful execution of this project. The ORP WFD IPT provides oversight of all aspects of the project, including technical, cost, and schedule issues.

This section defines the WFD organization, roles and responsibilities, and fieldwork strategies. The organization, roles, and responsibilities of the WRPS WFD team are described in Sections 8.1 through 8.3.

8.1 PROJECT ORGANIZATION

The WRPS WFD organization uses early involvement and ownership by Operations line management in the planning and execution of EPCC projects and the development of the work teams who will operate feed systems. The WFD Projects organization provides direction and scope while executing engineering, design, and procurement services. The tank farms project manager integrates the IWFD projects into the rest of the Base Operations organization fieldwork. The Tank Farms Projects organization provides construction management for the IWFD projects. An IPT, as defined in TFC-PLN-84, is used to support the project manager in planning and executing project upgrades. The IPT consists of project management and project controls personnel, project engineers, and functional area subject matter experts. Section 8.2 identifies the responsibilities of the different organizations that may participate on the IPT. These organizations include (but are not limited to) WFD Projects, Tank Farm Projects, and Base Operations.

The PEP delineates the IPT for the specific IWFD projects. The PMB defines the funding, and the functional area managers assign resources according to TOC priorities. The ORP Federal Project Director and his or her representatives are invited members of the contractor's IPT to provide visibility of progress and issues and improve communication of project needs. Additional key stakeholder interfaces are defined in Section 14.0, Table 14-1. Major subcontractors or vendors may be contracted to provide representation and decision authority for their organizations in the IPT, as determined by the project manager. The project manager will evaluate the project risks and communication needs to determine the roles and responsibilities of subcontractors and vendors.

Whenever practical, dedicated tank farms area managers, area engineers, and construction field teams will be used to support the upgrades and infrastructures in this project plan as integral members of the IPT.

IPT members are assigned specific responsibilities for each of the IWFD projects. The basis for preparation, review, and approval of deliverables required is found in the following procedures:

- TFC-PRJ-PM-C-02, Table 1, provides document responsibilities and minimum approvals
- TFC-ENG-DESIGN-C-06, *Engineering Change Control*, Table 1, identifies independent reviewers and approvers.

8.2 RESPONSIBILITIES

8.2.1 Waste Feed Delivery Projects

The WFD Projects organization is responsible for planning and project execution required for retrieval, mixing and blending, and delivery of DST waste to the WTP. The WFD Projects organization uses resources internal to WTP support for project development (i.e., mission analysis and strategic planning).

- **Project Management –** Responsible for the execution of projects through design and initial procurement of IWFD projects.
- **Project Engineering –** Supports IWFD projects through the design phase
- **Project Controls –** Maintains current cost and schedule information associated with upgrade projects
- **Environment, Safety Health and Quality (ESH&Q) –** Ensures that ESH&Q considerations are integrated into all work planning and execution associated with upgrade projects
- **Procurement Services –** Procures all design, fabrication, construction, testing equipment and suppliers, and spare parts.

8.2.2 Tank Farms Projects

The **Tank Farms Projects** organization is responsible for the construction and commissioning phases of IWFD projects.

- **Project Management –** Responsible for construction and commissioning of IWFD projects
- **Project Engineering –** Provides engineering support during the construction and commissioning phase and participates in the IPT during design activities
- **Construction Management –** Provides construction management services
- **Commissioning –** Provides testing, commissioning, and project readiness services
- **Turnover –** Provides the project turnover document and project closeout report services
- **Project Controls –** Maintains current cost and schedule information for the IWFD projects during the construction and commissioning phase of the project
- **ESH&Q –** Ensures that ESH&Q considerations are integrated into all work planning and execution associated with the IWFD projects, and also provides field support staff (e.g., radiological control technicians and industrial health technicians) to support construction forces
- **Procurement Services –** Procures all material, fabrication, and construction contract services.

8.2.3 Base Operations

The Base Operations organization is responsible for all fieldwork that occurs at the tank farms. When construction subcontracts are executed by the Tank Farms Projects organization, the fieldwork will be released by the Base Operations organization, which is responsible for safe work boundaries.

- **Work Area Manager –** Directs all operations associated with the assigned tank farms; staff is provided by area managers, as necessary, to complete IWFD projects
- **Waste Transfer Manager –** Performs retrieval from DSTs, blending and mixing, transfer to treatment facilities, and caustic additions
- **Engineering Manager –** Provides direct engineering support to O&M
- **ESH&Q Manager –** Ensures that ESH&Q considerations are integrated into all work planning and execution associated with Base Operations.

8.3 FIELD WORK STRATEGY AND RESPONSIBILITIES

8.3.1 Field Work Strategy

The fieldwork for the IWFD projects will be performed using the existing TOC processes. The construction phases will be managed in accordance with TFC-PRJ-CM-C-01 and construction performed by CLIN 1 projects. The fieldwork will be released through normal processes described in TFC-OPS-MAINT-C-01, *Tank Operations Contractor Work Control*, and conducted by the designated subcontractors or plant forces. Following construction, the Base Operations organization will perform the operational testing, readiness, and turnover portions with support from the project. Lessons learned from each stage will be applied to each successive farm upgrade.

8.3.2 Field Work Responsibilities

Base Operations is responsible for releasing fieldwork at the tank farms. The on-duty shift manager grants permission for the work that occurs at the tank farms facilities in accordance with TFC-OPS-OPER-C-08, *Shift Routines and Operating Practices*. The Tank Farms Projects organization provides the project with normal fieldwork support personnel such as nuclear chemical operators, industrial hygiene technicians, and health physics technicians. The IWFD projects will be performed within procedural requirements and safe-to-work boundaries established by the Base Operations organization.

Following construction, the Base Operations organization will conduct operational testing of each system to demonstrate integrated system performance. The system will be turned over to the Operations organization for use once integrated system testing is complete and operational readiness has been declared by the startup authority. Operation and maintenance of the systems will then be the responsibility of the Base Operations organization.

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9.0 RESOURCES AND STAFFING

The PMB defines the funding and resources that are assigned according to TOC priorities. Staff support is balanced between direct labor, staff augmentation, and subcontracts. WRPS maintains buy-back activities that may be used to level the staffing as funding levels change.

The plant forces work review process (described in TFC-BSM-HR_EM–C-05) is followed to ensure correct labor assignments for construction activities.

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10.0 RISK MANAGEMENT AND OPPORTUNITIES

Risk management is a factor considered when allocating resources to achieve project goals. The primary objective of risk management is to identify the risks and opportunities that could impact successful completion of the IWFD system, waste feed staging, or WFD to the WTP. Mitigation of these risks and engagement of the opportunities will be pursued.

The risk list developed for this project plan includes the related IWFD projects based on the project tailoring checklist in the individual project PEPs. The risk list was developed in accordance with the requirements of TFC-PRJ-PC-C-13, *Risk Management*, and TFC-PLN-39, and will be updated as needed during project implementation. This risk list will be maintained at the project level by the responsible project managers. The risks will also be incorporated into the company-level risk management process.

The risks and opportunities for the IWFD projects will be evaluated, with the assistance of the WRPS Risk Management Program Manager, to determine if they should be managed as a company-level risk. Risks not managed at the company level will be managed at the IWFD project or subproject level.

The initial risk list was obtained from RPP-40149 (Rev. 1) and was updated as described in Appendix E. An IPT assigned a probability and consequence to each risk. Probabilities and consequences were considered within the context of this project plan. Risk values were then derived based on the probability and consequence assignments.

Of the 68 identified risks, four have a risk value of “very high,” and 25 have a risk value of “high,” before implementing risk-handling strategies. Of the remaining risks, 36, three, and zero (none) have risk values (before implementing risk-handling strategies) of “medium,” “low,” and “very low,” respectively.

Table 10-1 includes the “very high” and “high” level risks. No additional decision analysis or simulation comparison has yet been conducted on these risks. Initial risk-handling strategies for mitigation effort are defined and will be revised as project management begins implementing actual project activities.

The complete listing of risks (unmitigated), with probability and consequence weighting, is provided in Appendix E. Identified opportunities are listed in Table 10-2.

Table 10-1. Significant Integrated Waste Feed Delivery Risks (6 pages)

No.	Risk	Company-level risk (TFC-PLN-39[a])	Risk value	Risk-handling strategy
Overall: Strategy				
S-1	Project plan is not stable.	TOC-11-087	H	• Maintain and manage risk list at project level • Manage IWFD projects under same organization that develops mission strategy • Update project plan, project execution plans, and PMB with revised System Plan(s)[b]
S-2	Skill mix and labor shortfalls from normal turnover and retirement.	TOC-10-055	H	• Offer early recruitment • Apply the same technical resources over multiple projects for cross-training
S-3	Work stoppage, resources not available.	TOC-10-055	H	• Maximize off-site engineering, fabrication, and construction
S-5	Tank farms-WTP interface communication is not successful.	TOC-11-057	H	• Establish routine communication with DOE Federal Project Director(s) on WTP interfaces • Engage ORP to implement proposed 2020 Vision One System approach • Periodically review existing ICDs and develop new ICDs as necessary
S-7	WTP commissioning delayed beyond FY 2018.	TOC-05-060	H	• Maintain current project execution plans consistent with the PMB and System Plan,[b] applying cost-effective hardware/project schedule strategies
S-12	Mixing delays WFD.	TOC-12-078	H	• Conduct mixing demonstrations • Pursue WRF, feed characterization facility, or mixed blend facility
S-20	WFD startup is linked with WTP ORR, requiring formal integrated ORR.	TOC-12-079	H	• Conduct preplanning; establish ORR working group to evaluate both options of connected and linked readiness planning • Perform readiness in support of Tank AY-102 mixing demonstration
S-21	WTP operational delays/extends WFD life-cycle.	TOC-05-060	H	• WTP conducts RAMI analysis consistent with federal and commercial guidelines to support extended WTP operation • Perform system planning

Table 10-1. Significant Integrated Waste Feed Delivery Risks (6 pages)

No.	Risk	Company-level risk (TFC-PLN-39[a])	Risk value	Risk-handling strategy
S-23	Extended schedule will require replacement of outdated technologies and equipment.	TOC-12-078	H	• Perform technology updates required for outdated equipment
S-25	ORP strategy on WTP operations is not stable due to continuing design changes or required changes identified during commissioning operations.	TOC-12-065	VH	• Establish routine communication with DOE Federal Project Director(s) on WTP interfaces • Execute sub-CLIN 3.2 workscope • Engage ORP to implement proposed 2020 Vision One System approach
S-26 (new)	Tank farms ventilation system upgrades required to meet safety-significant criteria[c] will incur additional cost and drive schedule delays, potentially impacting in-tank mixer testing and initiation of feed transfer to WTP.	TOC-11-075	H	• Perform integrated schedule management • Develop mitigation strategy with ORP in parallel with project planning • Conduct a value engineering session with ORP involvement
Overall: Budget				
B-1	Funding shortfalls.	TOC-11-087	H	• Establish high priority PMB scheduling to maximize engineering, procurement, and construction availability for farm upgrades
B-4 (new)	Funding shortfalls for ventilation system safety-significant upgrades.	TOC-11-087	H	• Establish high priority PMB scheduling to maximize engineering, procurement, and construction availability for farm upgrades
Overall: Stakeholder Requirements				
SR-7 (new)	Agency and regulatory requirements change.	TOC-11-075	H	• Monitor activities of outside agencies, to include pending (draft) regulatory changes or assessment activities • Provide best available impact analysis to client (ORP)

Table 10-1. Significant Integrated Waste Feed Delivery Risks (6 pages)

No.	Risk	Company-level risk (TFC-PLN-39[a])	Risk value	Risk-handling strategy
SR-8 (new)	Safety-significant requirements changed by the agency and/or regulatory requirements for new equipment or instruments being permanently installed.[d]	TOC-11-075	H	• Monitor activities of outside agencies, to include pending (draft) regulatory changes or assessment activities • Provide best available impact analysis to client (ORP)
Overall: Certification Requirements				
CR-1	WTP acceptance criteria not complete.	TOC-12-065	H	• Review WTP waste acceptance criteria against current state-of-the-art repository planning; continue interface with WTP on waste criteria • Engage ORP to implement proposed 2020 Vision One System approach
CR-2	Rheological properties are outside WTP criteria.	TOC-12-078 and TOC-12-019	H	• Implement technology maturity program to ensure that mixer pump designs and instrumentation are sufficient to validate rheology • Continue interface with WTP on waste criteria, qualifying 24590-WTP-ICD-MG-01-019[e] • Conduct alternatives analysis to treat waste (physically and chemically) outside WTP acceptance criteria
CR-3	DQOs are not achievable (e.g., TOC baseline not compatible with WTP RDQO requirements).	TOC-12-065	H	• Implement technology maturity program to ensure mixer pump designs and instrumentation are sufficient to meet DQOs • Continue interface with WTP on waste criteria, qualifying 24590-WTP-ICD-MG-01-019[e] • Conduct alternatives analysis to treat waste (physically and chemically)
CR-5	Dual mixer pumps are inadequate to mix across all tanks.	TOC-12-066	H	• Implement technology maturity program to ensure mixer pump designs and instrumentation are sufficient to address deep sludge mixing • Investigate new WRF

Table 10-1. Significant Integrated Waste Feed Delivery Risks (6 pages)

No.	Risk	Company-level risk (TFC-PLN-39[a])	Risk value	Risk-handling strategy
Equipment: Infrastructure				
EI-3	Insufficient electrical capacity for WFD multiple mixer pump operations.	TOC-12-011	H	• Engage Mission Support Alliance electrical utility group in preliminary design of tank farms infrastructure
Equipment: Installation				
EIN-5	Requirements are too stringent, eliminating commercial equipment supply (e.g., safety-significant ventilation system components).	TOC-11-075	H	• Prequalify equipment suppliers • Involve procurement chain as soon as safety-significant determination is made • Initiate commercial grade dedication activities on existing equipment
EIN-9	Transfer piping in the AN and AW Farms is not re-rated to 400 lb/in^2.	TOC-12-078	H	• Add contingency, as necessary, that piping systems will be replaced if they cannot be re-rated to the required pressures
Operations: General				
OG-4	Critical replacement equipment is not available when needed.	TOC-12-068	H	• Conduct RAMI analysis consistent with federal and commercial guidelines to support maintenance needs • Identify critical spares through procurements consistent with RAMI analysis results • Develop operations research model of the entire IWFD system and evaluate system performance to include effect of spares availability
OG-7	Transfer and mixer pumps burnout while operating in deep sludge.	TOC-12-066	H	• Administratively limit pump impeller operation to less than 70 in. of sludge depth
Operations: DST Mixing				
ODM-2	In-tank equipment (e.g., corrosion probes) will break during mixer pump operation, including incremental lowering.	TOC-12-078	VH	• Analyze in-tank equipment and reinforce as required
ODM-3	400 hp (electric) 305 hp (brake) mixer pumps are not adequate.	TOC-12-078 and TOC-12-066	H	• Reevaluate and optimize mixer pump performance requirements and revise procurement specifications accordingly • Perform full-scale stimulant testing of mixer pump operation

Table 10-1. Significant Integrated Waste Feed Delivery Risks (6 pages)

No.	Risk	Company-level risk (TFC-PLN-39[a])	Risk value	Risk-handling strategy
Operations: DST Retrieval/Transfer				
ODR-5	Ventilation systems replacement in AW and AN Farms are not adequate to support four mixer pumps operating simultaneously in each of the farms (see ODR-2), and may not be able to be upgraded to safety significant.	TOC-12-066	VH	• Conduct thermal hydraulic analysis to understand the tank's response and whether the vent system can manage offgas, including condensate; upgrade as required • AY/AZ Farm commissioning activity to validate thermal hydraulic analysis results
ODR-6	The operations of mixer pumps in the DSTs as the sole means for mixing/blending the sludge and supernate for waste feed delivery to the WTP may have a detrimental effect to the tank components as a result of erosion.	TOC-12-006	H	• Testing of tank coupons with simulants to determine extent, if any, of problem • Computational fluid dynamics analysis • Limiting the number of cycles a DST is allowed to be filled/transferred to WTP • Design/construction of a waste staging/blending facility for WTP feed
Operations: Staging DST Sampling				
OSS-1	Sampling actual feed stream not available for WFD.	TOC-12-064	VH	• Investigate aboveground sampling system in accordance with mixing/sampling demonstration program
OSS-2	Inadequate laboratory availability.	TOC-07-071	H	• Identify laboratory requirements by integrating DQO and 24590-WTP-ICD-MG-01-019[e] with mixing/sampling demonstration program • Design and increase capacity of sampling program

Table 10-1. Significant Integrated Waste Feed Delivery Risks (6 pages)

No.	Risk	Company-level risk (TFC-PLN-39[a])	Risk value	Risk-handling strategy
Decommissioning and Demolition				
DD-1	Decommissioning planning is not adequate.	TOC-11-054	H	• Design ensures decommissioning capabilities

[a] TFC-PLN-39, 2011, *Risk and Opportunity Management Plan*, Rev. G, Washington River Protection Solutions, LLC, Richland, Washington.

[b] ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U. S. Department of Energy, Office of River Protection, Richland, Washington.

[c] Section 5.3.7 provides further detail on safety-significant direction per ORP correspondence 11-AMD-054 (Dowell, J. A., and Bechtol, S. E., 2011, "Contract Number DE-AC27-08RV14800 – Transmittal of Contract Modification 094 and Request for Proposal to Upgrade the Double-Shell Tank Primary Ventilation Systems to Safety-Significant," [Letter 11-AMD-054/1101124 to C. G. Spencer, Washington River Protection Solutions, LLC, March 1], U.S. Department of Energy, Office of River Protection, Richland, Washington).

[d] Charboneau, S. L., 2012, "Contract No. DE-AC27-08RV14800 – Designation of New Installed Equipment Used to Support Technical Safety Requirements (TSR) as Safety-Significant (SS)," (Letter 12-NSD-0009/1200026 to C. G. Spencer, Washington River Protection Solutions, LLC, January 23), U.S. Department of Energy, Office of River Protection, Richland, Washington, and Bechtol, S. E., and Dowell, J. A., 2011, "Designation of Installed Equipment Used to Support Technical Safety Requirements as Safety-Significant – Request for Proposal," (Letter 11-NSD-023/1101145 to C. G. Spencer, Washington River Protection Solutions, LLC, March 11), U.S. Department of Energy, Office of River Protection, Richland, Washington.

[e] 24590-WTP-ICD-MG-01-019, 2008, *ICD 19 – Interface Control Document for Waste Feed*, Rev. 4, Bechtel National, Inc., Richland, Washington.

CLIN = contract line item number.
DOE = U.S. Department of Energy.
DQO = data quality objective.
DST = double-shell tank.
FY = fiscal year.
H = high.
ICD = interface control document.
IWFD = integrated waste feed delivery.
ORP = U.S. Department of Energy, Office of River Protection.
ORR = operational readiness review.
PMB = performance measurement baseline.
RAMI = reliability, availability, maintainability, and inspectability.
RDQO = regulatory data quality objective.
TOC = Tank Operations Contract.
VH = very high.
WFD = waste feed delivery.
WRF = waste retrieval facility.
WTP = Waste Treatment and Immobilization Plant.

Table 10-2. Integrated Waste Feed Delivery Opportunities

No.	Opportunities	Company-level opportunity	Implementation strategy
OPP-1	Flatten DST upgrade schedule	TOC-13-081	Integrate with FY 2011 PMB rebaselining scope.
OPP-5	Workscope projectization, streamlining, resource management, consolidation, and energy efficiency	TOC-13-081	Manage opportunities through PEP at same level of detail as risk listing.
OPP-6	HAMTC craft realignment provision	TOC-14-082	Identify to management and support company strategy.
OPP-9	Mixer pumps can be reused in other tanks	TOC-12-151	

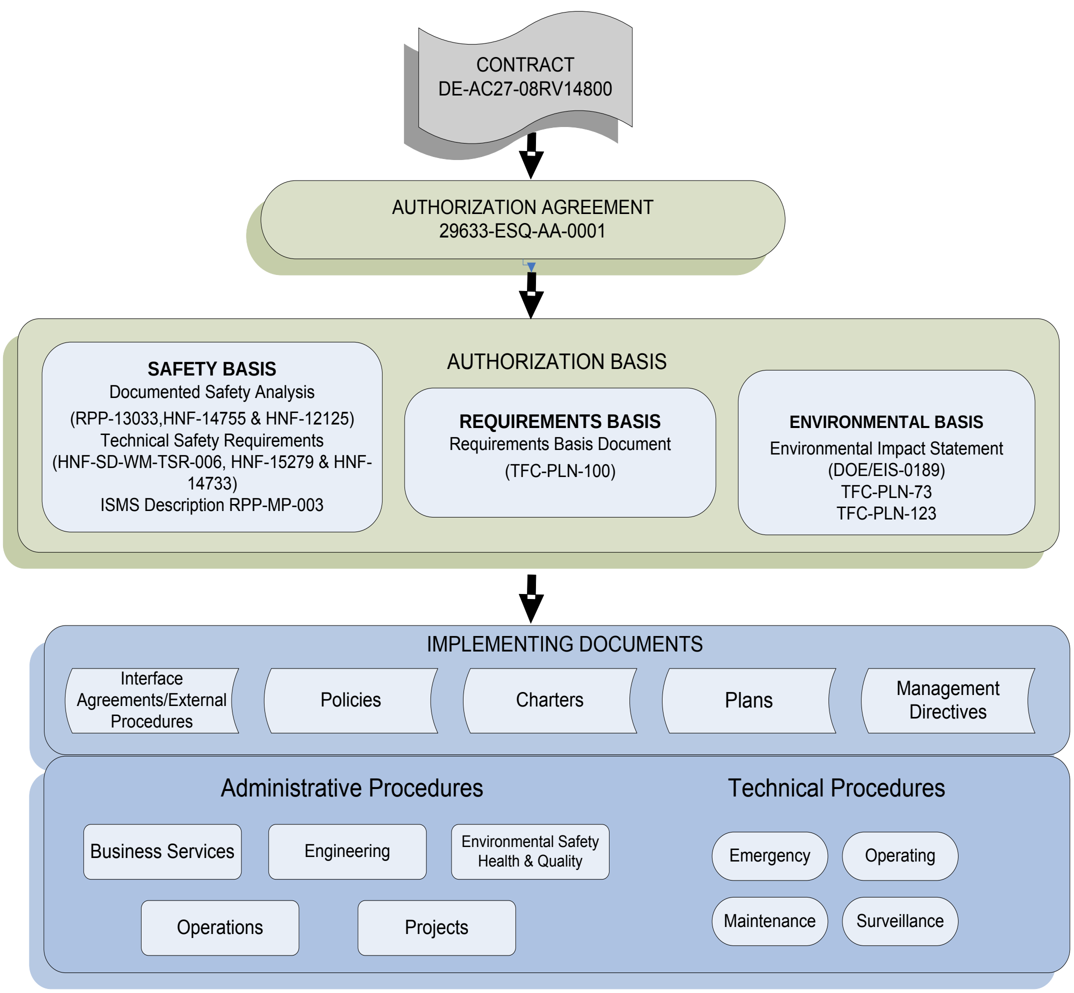
DST = double-shell tank.
FY = fiscal year.
HAMTC = Hanford Atomic Metal Trades Council.
PEP = project execution plan.
PMB = performance measurement baseline.

11.0 ADMINISTRATIVE AND TECHNICAL PROGRAMS

This section focuses on the administrative and technical programs that support project implementation, including the flow-down of requirements that govern work and the corresponding authorities. Section 11.1 describes the WRPS program for implementing administrative and technical procedures, and Section 11.2 describes the WRPS engineering program.

11.1 PROCEDURE PROGRAM

TFC-PLN-80, *Procedure Program Description*, describes the process for implementing the WRPS administrative and technical procedures. The procedure program ensures implementation of the TOC (DE-AC27-08RV14800) and Authorization Agreement (29633-ESQ-AA-0001, *River Protection Project Authorization Agreement between the U.S. Department of Energy, Office of River Protection and Washington River Protection Solutions, LLC*). As depicted in Figure 11-1, requirements flow down from the TOC into the authorization basis, and are implemented via interface agreements, policies, charters, plans, management directives, and procedures.



Source: Figure 1 of TFC-PLN-80, *Procedure Program Description*.

Figure 11-1. Washington River Protection Solutions Document Hierarchy

TFC-PLN-100, *Tank Operations Contractor Requirements Basis Document*, describes the process for establishing and maintaining the TOC requirements basis. TFC-PLN-100 identifies implementing documents associated with the TOC (DE-AC27-08RV14800, Section J, Attachment J.2, "Requirements"), including applicable laws and regulations, executive orders, and DOE directives, regulations, policies, and standards.

When changes occur in the ISMS regulatory requirement documents, these changes are flowed down through the hierarchy of documents via the procedure change process and are reflected in new revisions of policies, procedures and ISMS implementing documents. The organizations responsible for these documents implement the applicable requirements from the upper-tier documents into their respective internal procedures and processes.

11.2 ENGINEERING PROGRAM

11.2.1 Tank Operations Contract Engineering Execution

TFC-PLN-03 describes the TOC Engineering Program and the organization in place to ensure implementation of all aspects of engineering in support of the TOC workscope. It includes the Chief Engineer's role as the design authority for the tank farms, the Central Engineering organizations, and Deployed Engineering organizations.

11.2.2 Chief Engineer

The Chief Engineer serves as the "design authority" for the TOC facilities. The design authority is the sole organization or individual responsible for establishing and maintaining the design requirements, ensuring design output documents accurately reflect the design basis, and maintaining design configuration management and ultimate technical adequacy of the design process. The design authority is responsible for maintaining the technical baseline of the facility, including associated SSCs.

11.2.2.1 Central Engineering

The Chief Engineer is directly responsible for the central engineering function, and central engineering personnel are organized into several groups, with a functional manager for each group reporting directly to the Chief Engineer (TFC-CHARTER-01, *Tank Operations Contractor Charter*). These groups maintain the engineering standards, develop and maintain engineering procedures, develop and maintain authorization basis documents, serve as the interpretive authority for engineering requirements and operational specification documents, provide in-house design services, enhance engineering processes (automation and trending), lead tank integrity studies, provide the nuclear safety role (addressing unreviewed safety questions, developing documented safety analyses, etc.), and perform an oversight role for the application of engineering processes. This organization defines the process by which engineering personnel, who are deployed, perform their engineering functions.

11.2.2.2 Deployed Engineering

The deployed engineering personnel supporting operations, maintenance, and projects report directly to IPT management (TFC-CHARTER-01) and receive their work direction from the line organization, potentially including One System, Laboratory, WFD, Retrieval and Closure, Tank Farm Projects, and Base Operations. They execute that workscope based on approved engineering procedures that are authorized by the Central Engineering organization for use by TOC engineering groups.

The responsibility for the systems engineering role, configuration management in the field, system operability, control system design, process software development, corrective action resolution, and support for projects, and other technical activities for TOC systems is assigned to deployed engineers. Those who serve as system engineers are the design authority of their assigned systems and are responsible for all engineering activities related to their systems.

The system engineers, as delegated design authorities for assigned system(s), are ultimately responsible for the technical baseline and impact of any project on their systems. They work closely with project engineers to facilitate a technical baseline-compliant project. The design authority is ultimately responsible for the design agency output acceptance (product quality and technical and functional compliance) at each phase of the design review and the final acceptance.

Project engineers are deployed to project managers in the line organizations. These deployed project engineers plan, execute, manage, and review the production engineering activities in support of their assigned projects. As the design authority, this effort includes developing and identifying technical input and documents applicable to their project, managing the design agency activities (including subcontracted architect-engineering support, other subcontracted engineering support, and in-house scope), and orchestrating the review and acceptance of the resulting design products. They are responsible for design agency output acceptability (product quality and technical and functional compliance) as the design authority.

11.2.3 Tank Operations Contract Project Technical Requirements

Technical requirements for TOC project activities are developed and managed by implementing systems engineering principles within the engineering process. The key principles are a top-down definition with a bottoms-up verification to ensure a technically defensible solution.

The systems engineering process is a disciplined approach that supports project management in clearly defining the project mission, managing system functions and requirements, establishing bases for informed decision-making, and verifying that products and services meet project needs. Additional systems engineering information can be found in the TFC-PLN-03, Section 4.5.
The systems engineering process focuses on defining project needs and required functionality early in the preconceptual development cycle, documenting and validating requirements, and then proceeding with solution syntheses and verification, while considering all aspects of the solution through operations and decommissioning. The TOC tasks use a systems engineering approach in defining the mission need, evaluating alternatives, and selecting a preferred alternative.

Use of value management early in a project life-cycle is addressed in DOE M 413.3-1, *Project Management for the Acquisition of Capital Assets*. Historically, government agencies have applied several different names to describe the value management process, with value engineering being the most commonly used. Section 5.0 discusses a value engineering workshop conducted by the DST Upgrades Project in January 2009, which included expert panel review of alternatives and prioritization of work elements of the selected alternative.

Alternatives analysis is required to evaluate different alternatives and options that may arise throughout the RPP mission to integrate and comply with WFD requirements and the planning process. Implementation of the alternative analysis may change or alter course as uncertainties are resolved, risk mitigated, and operating experiences from down-stream facilities are developed and used to improve the overall approach.

Table 1 of TFC-PLN-03 lists projectized design activities that are applicable to TOC projects, including upgrades from this project plan. These activities include those needed to establish the design basis, execute the design, and verify the design.

11.2.3.1 Establish the Design Basis

The design basis consists of design inputs, design constraints, and the design analysis and calculations. It includes topical areas such as seismic qualification, fire protection, and safe shutdown. The design basis encompasses consideration of such factors as facility availability, facility efficiency, costs, and maintainability, and the subset that relates to safety and the authorization basis.

Using a systems engineering approach, analyses of system functions and requirements in system/subsystem specifications are conducted and documented. Appropriate industrial codes and standards and applicable DOE standards are included in the design basis.

A fundamental element of DOE capital asset acquisition is the integration of safety throughout the DOE acquisition management system. DOE-STD-1189-2008, *Integration of Safety Into the Design Process*, provides guidance and requirements on those actions and processes important for integrating safety into the acquisition process for DOE Hazard Category 1, 2, and 3 nuclear facilities. DOE-STD-1189-2008 describes the safety-in-design philosophies to be used with the project management requirements of DOE O 413.3B, and incorporates the facility safety criteria in DOE O 420.1B, *Facility Safety*, as a key foundation for safety-in-design determinations.

11.2.3.2 Execute the Design

The design agency is established through either an existing basic ordering agreement for design and engineering services, use of in-house design engineering services, or when a new subcontracted design/services contract is initiated, depending on the projectized activity scope and availability of qualified technical staff. Specific deliverable expectations are defined with a schedule of due dates, required deliverable formats, and the specific applicable TOC standards and procedures to be followed. All technical documents (calculations, drawings, engineering change notices, specifications, etc.) are prepared, reviewed, issued, and revised in accordance with the established TOC process. Configuration management is maintained as required in TFC-PLN-23, *Configuration Management Plan.*

11.2.3.3 Verify the Design

A design requirements compliance matrix is developed in accordance with the established TOC process. Established TOC processes are followed, including those for design verification/checking, interdisciplinary reviews, constructability and/or operational reviews (as applicable), and review by the project engineer(s) and system engineer(s) delegated design authority. Engineering obtains support from the Construction organization to perform constructability reviews and from Operations for operational reviews.

11.2.4 Technical Integration

The TOC strategic planning and mission analysis function integrates the TOC scope of work with technical, regulatory, and strategic planning data. This includes development and maintenance of the HTWOS model. The primary tools for TOC technical integration include the System Plan (Rev. 6) and the RPP integrated baseline.

The IWFD projects technical integration and interface with crosscutting TOC technical resources are discussed in Section 5.3.

11.2.5 Project Activity Support

Project activity support includes procurement, construction, and testing. Establishment of bills of materials, quality, storage levels, acceptance testing, and spare parts are included in the overall procurement process presented in TFC-BSM-CP_CPR-C-09, *Supply Chain Process*. Engineering support of procurement activities includes:

- Development of statements of work for design and construction packages in accordance with TFC-BSM-CP_CPR-C-05, *Procurement of Services*
- Assurance of correct quality attributes for procured items and materials in accordance with TFC-BSM-CP_CPR-C-06, *Procurement of Items (Materials)*, including commercial grade item dedication, as required, in accordance with TFC-ENG-DESIGN-C-15, *Commercial Grade Dedication*
- Management of spare parts in accordance with TFC-BSM-CP_CPR-C-19, *Controlling Spare Parts and Spare Equipment Inventory*
- Review, approval, and management of supplier and subcontractor documentation in accordance with TFC-BSM-IRM_DC-C-07, *Vendor Processes*.

As addressed in Section 5.5.2, WRPS is implementing the ITAAC process. Engineering support of testing processes includes:

- Selection of design requirements verification methods in accordance with TFC-ENG-DESIGN-P-17, *Design Verification*
- Establishment of procurement specification factory acceptance testing requirements in accordance with TFC-BSM-CP_CPR-C-06
- Establishment of construction acceptance, nondestructive examination, cleanliness, and component functional testing requirements in accordance with TFC-BSM-CP_CPR-C-05

- Performance of startup and testing responsibilities described in TFC-PLN-26, *Test Program Plan*
- Performance of operational readiness responsibilities described in TFC-PLN-16, *Operational Readiness Program Plan*
- Performance of construction turnover responsibilities described in TFC-PLN-72, *Project and Facility Turnover Program Plan*.

11.3 NUCLEAR SAFETY

11.3.1 Safety Basis

Title 10, *Code of Federal Regulations*, Part 830, "Nuclear Safety Management" (10 CFR 830) requires contractors responsible for a Hazard Category 1, 2, or 3 DOE nuclear facility to establish and maintain a safety basis for the facility to ensure adequate protection to the public, workers, and the environment. TFC-ENG-SB-C-01, *Safety Basis Issuance and Maintenance*, describes the safety basis document issuance and maintenance process, including amendments to the current safety basis. TFC-ENG-SB-C-06, *Safety Basis Development*, provides the requirements and processes for developing documented safety analyses, technical safety requirements, preliminary documented safety analyses, and hazard category designations for new Hazard Category 1, 2, and 3 DOE nuclear facilities or major modifications to existing Hazard Category 1, 2, or 3 nuclear facilities. DOE-STD-1189-2008 provides a checklist to determine if a project is a major modification.

It is anticipated that some aspects of this project plan will require amendments to RPP-13033, *Tank Farms Documented Safety Analysis*, and HNF-SD-WM-TSR-006, *Tank Farms Technical Safety Requirements*, to incorporate WFD activities and operations. The overall IWFD system will be managed as a set of subprojects (e.g., infrastructure upgrades, primary ventilation system upgrades, and in-tank upgrades that include mixer pump and waste transfer pump installation). When the hazard analysis for each subproject scope is sufficiently developed, the major modification evaluation based on DOE-STD-1189-2008 will be formalized. If the subproject is not categorized as a major modification, any required amendments will be processed via TFC-ENG-SB-C-01. Amendments for major modifications (which require development of a preliminary documented safety analysis) will be processed via TFC-ENG-SB-C-06.

Once the nuclear safety basis of a TOC project is established, the Engineering organization supports maintenance of its integrity through implementation of the systems engineering program, which ensures operational readiness of the safety-class and safety-significant SSCs within its scope, in accordance with DOE O 420.1B.

Progress made on the IWFD system relative to the safety basis includes:

- A safety design strategy (RPP-49053, *Safety Design Strategy for the Waste Feed Delivery Integrated AY-102 Upgrades Project*) has been approved for the upgrade of DST AY-102, the first DST that will receive the mixer pump and waste transfer pump upgrades. RPP-49053 documents the results of the major modification evaluation for the three associated subprojects: AY/AZ Farms infrastructure upgrades, AY/AZ ventilation tank primary system upgrades, and Tank AY-102 in-tank upgrades.

It concluded that the AY-102 in-tank upgrades subproject is a major modification and requires a preliminary documented safety analysis, while the other two subprojects are not. RPP-49053 will be revised as the design matures.

- The process hazards analysis for the IWFDP was revisited to consider the 30 percent design for the Tank AY-102 in-tank upgrades subproject and the effects of mixer pump operation. The results of this process hazards analysis are documented in RPP-RPT-43205, *Process Hazard Analysis (PrHA) for the Integrated Waste Feed Delivery Plan – Update 2010.*
- Process hazards analyses have been conducted on the 60 percent designs of the AY/AZ Farm infrastructure upgrades subproject and the AW Farm infrastructure upgrades subproject. These process hazards analysis reports have not been released.
- A safety design strategy (RPP-44427, *Safety Design Strategy for the Waste Feed Delivery Transfer Line Upgrades Project – SY Transfer Line Replacement*) for the SY transfer line replacement project has been approved by ORP and released.
- The process hazards analysis report (RPP-RPT-46804, *Project W-566 Waste Feed Delivery - Transfer Line Upgrades 241-SY Transfer Line Replacement Process Hazards Analysis Report*, was completed for the SY transfer line replacement project.

11.3.2 Criticality Prevention

Prevention of nuclear criticality is managed at TOC facilities in accordance with TFC-PLN-49, *Tank Operations Contractor Nuclear Criticality Safety Program*, as required by:

- 10 CFR 830.204(b)(6), “Documented Safety Analysis”
- DOE O 420.1B, *Facility Safety*, Attachment 2, Chapter III, “Nuclear Criticality Safety”
- RPP-13033, *Tank Farms Documented Safety Analysis*
- HNF-SD-WM-TSR-006, *Tank Farms Technical Safety Requirements*, Administrative Control 5.9.5, “Nuclear Criticality Safety.”

As defined in TFC-PLN-32, *Tank Operations Contractor Safety Management Programs*, the Chief Engineer is the Executive Sponsor of the TOC criticality safety management program, and the Nuclear Safety Manager is the owner of the program. The criticality safety program applies to all processing and transfer operations, transport and storage activities, and waste from operations involving fissionable material.

It is anticipated that the some aspects of the IWFD system (e.g., mixer pump operation) will require additional criticality analysis. This criticality analysis will be integrated into the broader objective of aligning the tank farms criticality safety program with the WTP program.

11.4 QUALITY ASSURANCE

This section describes the approach that WRPS, as the Tank Operations Contractor, will use for implementing the quality assurance (QA) requirements mandated by contract for the IWFD system. The QA program is planned, implemented, and maintained in accordance with quality requirements derived from 10 CFR 830.122 and DOE O 414.1D, *Quality Assurance*, criteria, and implemented using the national consensus standard American Society of Mechanical Engineers (ASME) NQA-1-2004 (through 2007 Addenda), *Quality Assurance Requirements for Nuclear Facility Applications*.

TFC-PLN-02, *Quality Assurance Program Description* (QAPD), is the management system that implements the requirements of DOE O 414.1D, and 10 CFR 830, Subpart A, "Quality Assurance Requirements," for managing, performing, and assessing the adequacy of work. The QAPD integrates, where practicable and consistent with contract or regulatory requirements, quality management program requirements, as defined in DOE O 414.1D, with other quality or management system requirements in DOE directives and external requirements.

Other technical commitments (e.g., ANSI/ISA S84.00.01-2004, *Functional Safety: Safety Instrumented Systems for the Process Industry Sector*, for safety instrumentation software; ISO 10007:2003, *Quality Management Systems - Guidelines for Configuration Management*, and ANSI/EIA 649-B-2011, *Configuration Management Standard*, for configuration management; and ASME Section VIII, *Boiler and Pressure Vessel Code*, for vessels) are identified in various authorization basis documents, incorporated in the basis of design or other documents and plans, and implemented through procedures and specifications, as applicable.

WRPS conducts work in accordance with the QAPD and, where appropriate, uses a graded approach to implement the requirements therein. Requirements sources are cited within the QAPD as an aid in confirming compliance. Non-mandatory guidance sources are cited within the QAPD as an implementation aid. Management requirements are imposed by the TOC. QA requirements will also flow down to the respective PEP for each of the IWFD projects.

To ensure adequate vendor capability to satisfy future mission requirements, WRPS construction and commissioning personnel have assisted several local small businesses (construction contractors) with the development of their ASME NQA-1 QA programs. The intent is to help these contractors achieve "qualified supplier" status for placement on the Mission Support Alliance (MSA) acquisition verification services evaluated suppliers list as construction services providers for safety-significant construction work.

11.5 SECURITY AND EMERGENCY MANAGEMENT

11.5.1 Safeguards and Security

The IWFD system will implement the tank farms safeguards and security program mandated by TFC-PLN-79, *Safeguards and Security Management Plan*, and the implementing procedures therein. The safeguards and security measures currently implemented in the Hanford Site 200 Areas by WRPS, in conjunction with the MSA, are sufficient to protect personnel, information, and material associated with the IWFD system. No special or additional safeguards and security measures are envisioned. Project design reviews will include a review from the WRPS safeguards and security program lead to ensure that existing safeguards and security measures are adequate.

11.5.2 Emergency Management

The emergency management program is designed to protect workers, the public, and the environment by assisting workers in the recognition, understanding, and reaction to hazardous scenarios in the workplace. Emergency management will be controlled within the requirements documents and processes identified in TFC-PLN-85, *Emergency Management Program Plan*, for all of the WRPS facilities, including the IWFD systems. New activities are addressed through the process hazards analysis review by Nuclear Safety. Any activities affecting the emergency management requirements of TFC-PLN-85 (DOE O 151.1C, *Comprehensive Emergency Management System*) are addressed as part of the process hazards analysis.

11.6 PROJECT ADMINISTRATIVE SYSTEMS

Document control for the IWFD projects is implemented through TFC-BSM-IRM_DC-C-01, *Document Control*. This procedure directs use of the correct implementing procedures needed to prepare, review, approve, distribute, use, and revise document types required to be controlled. Such documents include any record information, regardless of its physical form or characteristics.

Records for the IWFD projects are managed through adherence to TFC-BSM-IRM_DC-C-02, *Records Management*. This procedure addresses the processes and controls for managing material needing retention for administrative, legal, research, scientific, or historical value (record material), regardless of the media or format, in accordance with statutory, regulatory, and contractual requirements. Management of records includes identification, collection, processing, protection, storage, retrieval, and disposition of the records.

Project-specific procedures will be developed, as necessary. Any project-specific procedures will conform to the requirements of TFC-OPS-OPER-C-13, *Technical Procedure Control and Use*, or TFC-BSM-AD-C-01, *Administrative Document Development and Maintenance*.

11.7 WORK AUTHORIZATION

Work authorization is provided to the CAMs by the Tank Operations Project Manager. The CAM is responsible for developing the control account plan. All subcontracted work is managed and controlled by the CAMs. The CAM assignments are maintained under configuration control in the HPIC module by the HPIC system administrator. CAM approval/acceptance of their control account plan is documented by signature on the latest baseline change request affecting the control account. The CAM's roles and responsibilities are defined in RPP-7725. The funding allocation is provided with the project direction notice, as documented in TFC-PRJ-PC-C-12.

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12.0 ENVIRONMENTAL, SAFETY, AND HEALTH PROGRAMS

This section describes general programmatic implementation of environmental, safety, and health programs to prepare the DST systems for feed delivery to the WTP. Specific project applications of programmatic elements are also described.

12.1 ENVIRONMENTAL COMPLIANCE

Sections 12.1.1 through 12.1.9 evaluate applicable regulatory requirements and propose likely paths forward to ensure compliance, based on the current understanding of the upgrade projects.

12.1.1 National Environmental Policy Act and State Environmental Policy Act

To ensure adequate *National Environmental Policy Act of 1969* (NEPA) and *State Environmental Policy Act of 1971* (SEPA) compliance for the IWFD projects, a NEPA checklist will be completed in accordance with TFC-ESHQ-ENV_AP-C-01, *NEPA, SEPA, Cultural, and Natural Resources*. To assist with the NEPA compliance process, the TC & WM EIS that is currently in review will be used. The draft TC & WM EIS was released in October 2009 and the final EIS is planned to be released in the spring of 2012. The record of decision is planned to be issued six months after the EIS is released. The Tank Operations Contractor will establish a decision point at least one year prior to the need date for NEPA compliance for any given project to evaluate pursuing an alternative NEPA action, if the final TC & WM EIS and record of decision is delayed or is determined not to ensure compliance.

When a proposed project or operational activity might affect a cultural or historical property or structure, disturb a Native American artifact, or occur outside the 150 m perimeter of applicable tank farms, as specified in the annual tank farms cultural and ecological resources review provided by Pacific Northwest National Laboratory, personnel must request and obtain a cultural and ecological resources review from the Hanford Cultural Resources Laboratory. This process ensures protection of endangered species, migratory birds, and any cultural or historic artifacts.

12.1.2 Hanford Federal Facility Agreement and Consent Order

Implementing the IWFD system designs has minimal impact on the current milestones identified in the TPA. Several activities associated with tank waste retrieval planning and physical removal of the waste may require renegotiation in the event that the WTP is unable to meet its planned schedule.

12.1.3 Resource Conservation and Recovery Act

Modifications to the DST system to support WFD will require *Resource Conservation and Recovery Act of 1976* (RCRA) permit modifications after the DST permit is issued. The RCRA permit modifications are categorized in the following classes.

- Class 1 modifications address routine and administrative changes, including updating, replacing, or relocating emergency equipment.
- Class 1-Prime modifications are similar to Class 1, in that they are simple in nature but potentially have greater impacts than a standard Class 1 modification. Examples include change in ownership or operator, removal of permit conditions that are no longer applicable, and changes in interim compliance dates.

- Class 2 modifications address facility-initiated changes in the types and quantities of wastes managed, technological advances, and new regulatory requirements, where such changes can be implemented without substantively altering the facility design or management practices.
- Class 3 modifications propose major changes to units, operational constraints, or permit conditions.

As the class of modification increases from 1 through 3, the time necessary to complete the permit modification and the degree of public involvement also increases. Class 1 modifications generally take from two to four months to complete, but may be implemented prior to acceptance by the Washington State Department of Ecology (Ecology). Class 1 modifications are the only type that can be implemented prior to Ecology acceptance. Class 1-Prime modifications generally take two to six months to complete and require Ecology acceptance prior to implementation. Class 2 modifications typically take six to nine months. Class 3 modifications require the greatest level of effort from both the permit requestors and regulators, and often take more than a year to achieve.

A RCRA final status permit is in the process of being issued for the DST system, and will be included under the Hanford Site-wide RCRA permit. Preliminary draft conditions have been proposed by Ecology, and comments have been submitted by ORP and WRPS. As required by WAC 173-303, “Dangerous Waste Regulations,” Ecology’s draft permit conditions for the DST system must be submitted for public review and comment prior to being finalized. Since equipment will be installed within the tanks and changes will be made to portions of the tank system, a modification to the DST permit will be required. Supplemental information may be transmitted to Ecology for incorporation into the draft DST permit prior to public participation activities.

The types of changes currently identified would constitute a Class 2 modification request in accordance with WAC 173-303, Subpart 830, “Permit Changes.” It is recommended that the class of modification be negotiated with Ecology prior to submittal.

Due to the period of time required to prepare, submit, and approve a modification request, the best strategy to limit the impact to the project is to manage the submittal of modifications required. As the projects mature through design, procurement, and construction, the permit submittals will be kept current and will present all changes through modification requests. Elements necessary to reduce the number of modification request submittals required include complete design information, early interaction with all affected organizations including the regulating agencies, and agreement in advance with the regulators of the process to be used.

12.1.4 Clean Air Act

The installation and operation of the IWFD system equipment will affect the current Hanford air operating permit. Environmental personnel have completed an evaluation to determine if the estimated increase in emissions resulting from a modification to the existing system qualifies for an exemption and have determined that the IWFD projects will require a notice of construction (NOC) application to Ecology and the Washington Department of Health (WDOH) detailing the proposed modifications to the DST system. Depending on the level of modeling necessary to support the NOC, drafting the application generally takes four to six months.

Additionally, new regulations have been implemented indicating that a health impacts assessment is needed. The health impacts assessment has been prepared; however, it may require modification as ventilation system designs mature.

As with RCRA, the best strategy to manage the impact of air permitting requirements is to involve the regulatory agencies at the earliest point possible. The permit submittals will be kept current and will present all changes through modification requests prior to submitting an NOC application.

It is also important that an evaluation of any construction activities with the potential to impact air emissions, such as fugitive dust emissions or motorized equipment, is completed prior to initiating any such activity. This process ensures that adequate documentation exists to justify an exemption or develop a new or modified permit.

12.1.5 Comprehensive Environmental Response, Compensation and Liability Act

When it is determined that work disturbs soils or facilities in areas governed by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), the affected activities must be evaluated and coordinated with the Environmental Projects Manager who will coordinate activities with the Hanford Plateau Remediation Contractor. Coordination meetings between the Tank Operations Contractor and Plateau Remediation Contractor must be scheduled to ensure that appropriate notifications, approvals, and mitigation actions have been completed prior to disruption of CERCLA areas of contamination.

12.1.6 Toxic Substances Control Act

Modifications to or replacement of SSCs, as part of this project plan, may encounter polychlorinated biphenyls (PCB) and asbestos. TFC-ESHQ-ENV-STD-02, *Regulated Substance Management*, identifies requirements and provides guidance for appropriately managing PCBs and asbestos, and protecting workers. Adequate work planning, including job hazards analysis, is crucial to successfully dealing with these potential concerns. By identifying the potential hazards early in the process, mitigation, and required notifications can be incorporated into scheduled activities, minimizing the potential for personnel exposure or costly delays.

12.1.7 Water Connections

New water connections or changes to existing water connections must be reviewed in accordance with TFC-ESHQ-ENV_RM-C-04, *Ensuring Water Quality*. All proposed modifications must be reviewed by the Hanford Utilities Water Purveyor, currently at the MSA. Depending on the degree of modification required, the plans may need to be submitted to and approved by the WDOH. Certain modifications may be covered under existing variances approved by the WDOH.

12.1.8 Emergency Planning and Community Right-To-Know Act

Any chemicals brought onsite for construction, testing purposes, or other uses must be evaluated and tracked in accordance with TFC-ESHQ-S_IH-C-47, *Chemical Management Process*. In this way, the appropriate safety information can be obtained and the materials accounted for during annual *Emergency Planning and Community Right-To-Know Act of 1986* reporting exercises.

12.1.9 Other Considerations

As part of the ISMS process, the project must identify proposed activities with significant environmental impacts and develop documented objectives and targets for them. These objectives and targets must also support DOE's sustainability goals regarding energy use, fuel and water conservation, and vehicle management and pollution prevention. These requirements must be flowed down to subcontractors and considered during the procurement of project materials.

A pollution prevention opportunity assessment will be completed in the early phases of the project so that any opportunities identified can be incorporated into the design and or project management plans.

The Chemical Management organization must approve any chemicals proposed to be brought onsite. Certain equipment contains material that also has the potential to contain ozone-depleting substances or PCBs. Such equipment must be identified and controlled prior to locating it at Hanford.

A significant component of this project plan is the removal and disposition of existing tank equipment and support infrastructure that is not compatible with IWFD system operations. Waste is anticipated from existing tank farms equipment removal activities, in-tank equipment removal, decontamination and demolition, construction, and operations.

The WRPS waste minimization program emphasizes source reduction and segregation as the main objective, with reduction of volume and toxicity as the secondary objective. The minimization plan is described in TFC-PLN-33, *Waste Management Basis*, and TFC-PLN-73, *Environmental Protection and Compliance Plan*.

Waste will be managed in compliance with applicable requirements, including DOE O 435.1, *Radioactive Waste Management*; WAC 173-303; 40 CFR, "Protection of Environment;" and 10 CFR, "NRC Regulations." Activities will be carried out in a manner that protects human health and the environment and ensures regulatory compliance. When federal, state, or local requirements are more stringent than DOE O 435.1 requirements, the requirements are implemented by compliance with the most stringent regulator.

Materials that can be recycled will be recycled. Waste planning will include waste minimization by source reduction.

DOE O 435.1 requires that life-cycling planning should be completed as an effective way to avoid problems in the management of waste. Waste minimization and pollution prevention requirements are included in the planning process to ensure that life-cycle costs and potential liability, and protection of public health and the environment are considered. Life-cycle planning and waste forecasting are integrated with treatment, storage, and disposal organizations external to WRPS so that resources and storage availability may be assessed and planned.

Treatment and packaging will be determined by waste characterization and the size of the waste items. Waste will be characterized based on the database of best available data and specific information from the waste generator.

Waste will be managed under RCRA and DOE O 435.1 requirements and shipped to a treatment, storage, and disposal facility within 90 days for mixed low-level waste (MLLW) and 365 days for low-level waste (LLW).

Waste will be transported in accordance with 49 CFR, "Transportation," and DOE/RL-2001-36, *Hanford Sitewide Transportation Safety Document*.

If removed long-length equipment is determined to be TRU waste, the TRU portion will be removed and packaged to meet the Waste Isolation Pilot Plant (WIPP) waste acceptance criteria; the remainder will be packaged and disposed as LLW to minimize the amount of TRU waste generated.

12.1.10 Tank Equipment Removal Methods

Figure 12-1 shows the typical removal and installation of DST equipment. Equipment is removed from the tank with a crane. It is sleeved and rinsed/decontaminated as it is removed. The equipment is then lowered into a storage area until it can be loaded into the transport/disposal container in preparation for shipment to a mixed waste treatment, storage, or disposal facility as appropriate. Equipment for installation is lifted from the flatbed trailer and inserted in the tank riser with a crane. A "greenhouse-like" structure is erected around the installation riser to control a potential contamination spread.

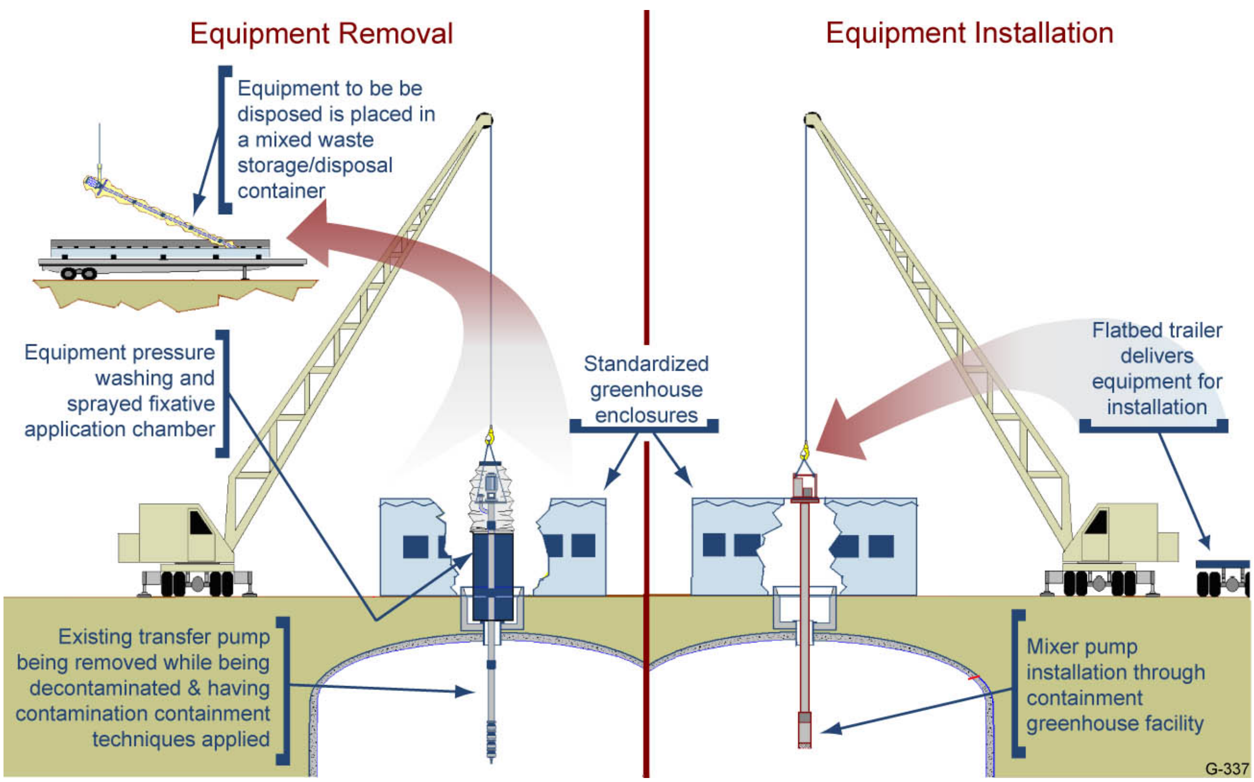

Figure 12-1. Equipment Removal and Installation

12.1.11 Waste Sources and Types

To prepare for the new IWFD systems, existing equipment must be removed and disposed by the IWFD projects. Equipment and secondary waste that have come into contact with tank waste are generally assumed to be MLLW. All other wastes are assumed LLW, unless otherwise characterized, based on waste stream specific generator information.

Waste from in-tank equipment and existing transfer line removal will produce wastes consisting of mixer pumps, transfer pumps, thermocouple trees, corrosion probes, and other equipment. Since this equipment will be removed from the tanks, it is considered secondary MLLW, and must undergo a waste incidental to reprocessing determination. Waste will be generated from the construction and operation of the IWFD systems. These wastes are expected to be secondary LLW or MLLW, with a possibility of some TRU waste.

12.1.12 Secondary Waste

Secondary waste can be generated from equipment installation and system construction, reusable pump operations, and waste from IWFD system maintenance. Such wastes are addressed in standard procedures. Secondary wastes are expected to be LLW or MLLW, if they have come in contact with tank waste, or possibly TRU waste.

12.1.13 Waste Disposition

Treatment options include the following:

- **Volume reduction –** Compaction, thermal (incineration)
- **Size reduction –** Cut up large equipment, if unable to package, and ship as-is
- **Macroencapsulation –** Grout in container or at disposal facility.

Treatment will be performed both offsite and onsite as appropriate. Planning is based on on-site spraying of equipment as it comes out of the tank until dose rates are <200 mrem/hr on contact, followed by disposal onsite. Exceptions include equipment coming out of the TRU waste tanks (Tanks AW-103, AW-105, and SY-102) or equipment that is characterized as TRU based on calculations of residual waste in the equipment. The equipment characterized as TRU waste will be cut up and placed in WIPP-compliant packaging to be shipped offsite for disposal. TRU waste components may be shipped offsite for size reduction and placement in WIPP-compliant packaging.

On-site treatment will require the use of a greenhouse or some other containment structure to prevent contamination spread. Macroencapsulation can be performed onsite at the disposal facility. This approach is preferable for long-length equipment because size reduction can be avoided.

12.1.14 Disposal Options

Typically non-TRU waste, LLW and MLLW will be packaged and shipped for on-site disposal at the Environmental Restoration Disposal Facility, Integrated Disposal Facility, or the low-level burial grounds. However, the option exists to ship LLW and MLLW to an off-site facility for treatment and return it for on-site disposal. The Integrated Disposal Facility is currently not available for waste disposal, but is expected to be ready to receive waste in FY 2014.

12.2 SAFETY MANAGEMENT

12.2.1 Integrated Safety Management System

The WRPS ISMS is structured to integrate ESH&Q into work planning and execution. Integration of ESH&Q enables the IWFD systems to be operated efficiently and effectively, while protecting the workers, the public, and the environment.

This project plan uses the following five core functions of ISMS in developing and planning workscope.

Figure 12-2. Integrated Safety Management System

1. **Define the scope of work –** Missions are translated into work, expectations are set, tasks are identified and prioritized, and resources are allocated.
2. **Identify the hazards –** Hazards associated with the work are identified, analyzed, and categorized.
3. **Develop and implement hazard controls –** Applicable standards and requirements are identified and agreed-on, controls to prevent/mitigate hazards are identified, the safety envelope (authorization basis) is established, and controls are implemented.
4. **Perform work within controls –** Readiness is confirmed, and work is performed safely.
5. **Provide feedback and continuous improvement –** Feedback information on the adequacy of controls is gathered, opportunities for improving the definition and planning of work are identified and implemented, line and independent oversight is conducted, and, if necessary, regulatory enforcement actions occur.

In addition, the following seven guiding principles of ISMS will be applied to the IWFD projects to provide for safe work execution.

1. **Line management responsibility for safety –** Line management is directly responsible for the protection of the workers, the public, and the environment. As a complement to line management, the DOE Office of Health, Safety, and Security provides safety policy, enforcement, and independent oversight functions.
2. **Clear roles and responsibilities –** Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the DOE and its contractors.
3. **Competence commensurate with responsibilities –** Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to fulfill their responsibilities.

4. **Balanced priorities** – Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the workers, the public, and the environment shall be a priority whenever activities are planned and performed.
5. **Identification of safety standards and requirements –** Before work is performed, the associated hazards shall be evaluated and an agreed-on set of safety standards and requirements shall be established, which, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.
6. **Hazard controls tailored to work being performed –** Administrative and engineering controls to prevent and mitigate hazards shall be tailored to the work being performed and the associated hazards.
7. **Operations authorization –** The conditions and requirements to be satisfied for operations to be initiated and conducted shall be clearly established and agreed on.

12.2.2 Industrial Safety

The WRPS industrial safety program reduces employee injuries from industrial hazards that may be encountered in the workplace. The fire protection program, an element of the industrial safety program, focuses on controlling and eliminating fire hazards in the workplace, minimizing fire losses, and ensuring life safety. Company-wide program requirements and procedures establish a baseline for compliance with applicable industrial safety codes and standards. Industrial safety concepts are integrated in various safety management processes as they apply to identifying and analyzing hazards and determining the appropriate controls for employee protection. Implementation of the industrial safety requirements is the responsibility of line management, supported by industrial safety professionals who are assigned to the area and facility safety and health managers.

The worker safety and health program applies to work implemented on any of the IWFD projects, including any subcontracted workscope. Through implementation of this program, the IWFD projects will be managed to ensure a safe and healthy work environment and apply methods and controls for compliance with the requirements in 10 CFR 851, “Worker Safety and Health Program.” The controls placed on work activities are intended to reduce or prevent occupational injuries, illnesses, and accidental losses. The WRPS industrial safety program contains requirements for management responsibilities, worker rights, and responsibilities; hazard identification and assessment; hazard prevention and abatement; safety and health standards; functional areas; training and information; and recordkeeping and reporting.

12.2.3 Industrial Hygiene

The goal of the WRPS industrial hygiene program is to reduce employee occupational illnesses from chemical, biological, physical, and ergonomic hazards that may be encountered in the workplace. Company-wide program requirements and procedures establish a baseline for compliance with applicable industrial hygiene codes and standards. Industrial hygiene concepts are integrated into various safety management processes, as they apply to identifying and analyzing hazards and determining the appropriate controls for employee protection.

Implementation of the industrial hygiene requirements is the responsibility of line management, supported by industrial hygiene professionals who are assigned to the area and facility safety and health managers. Industrial hygiene professionals act as liaisons between WRPS and the other Hanford Site prime contractors providing occupational medical services, laboratory services, instrument calibration, and the material safety datasheet program.

The main industrial hygiene issue will be the characterization of chemical vapors during project work. WRPS is currently reviewing, evaluating, and in some cases testing to determine if additional instrumentation will be useful in providing information on chemical vapor exposures. The IPT will actively participate in these efforts. If identified as needed, additional instrumentation may be deployed for the IWFD projects. It is also expected that work activities specific to the project will need to be characterized, especially during the first few tank upgrades, after which ongoing routine industrial hygiene sampling and monitoring will continue. These efforts are expected to require industrial hygiene technician support, sampling plans development, and complete chemical exposure hazard analysis. Additional equipment and instrumentation will be supplied to support these activities. In addition, sampling plans and operating procedures will be created to respond to abnormal events such as chemical spills or unexpected exposures.

Improved methods and designs will be employed in tank farms activities where appropriate. For example, a stack extension design has been developed and evaluated. It will be deployed in the retrieval of SST C-111 waste.

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13.0 ACQUISITION PLAN

The WRPS acquisition plan is defined in RPP-6113, *WRPS Acquisition Plan*. All procurements will be performed in accordance with TFC-BSM-CP-CPR-C-05 and TFC-BSM-CP_CPR-06, and the associated internal procurement procedures.

Key acquisition strategies for maximizing procurement efficiency for the IWFD projects include the following.

- Design services, when required, will be obtained through competitive procurements. Technical merit and pricing will be factors used to select and award a contract to one of the qualified companies that submitted a proposal.
- Long-lead procurements will be initiated by WRPS and provided as government-furnished equipment to the construction subcontractor. Items to be provided as government-furnished equipment shall be determined based on factors such as complexity, uniqueness, and schedule delivery requirements. In general, government-furnished equipment will be competitively bid as firm-fixed price contracts.

  Hanford submersible mixer pumps and other pumps will be procured from one or more preferred providers selected from a competitive solicitation. All designs for mixer pumps will start at least as one-size-fits-all bases.
- Construction services will be obtained by soliciting competitive proposals. Where design and field conditions warrant, construction subcontracts will be awarded as firm-fixed price contracts. The major exception will be for scopes of work within the tank farms boundaries. Subcontracts in these areas will be time and materials due to the large number of unknowns that have the potential for impacting performance of the work, including potential impacts caused by existing field and radiological conditions, the age of the existing facilities and the poor configuration control practices of the past, and the impact of ongoing O&M activities. Solicitations will be issued in phases, sequenced as determined by the IWFD projects schedule. Initial awardees in each tank farm will be the subcontractor of choice for subsequent phases of construction activities in that farm, assuming acceptable subcontractor performance to-date, to allow that subcontractor to develop and maintain an experienced crew to safely perform the work.
- QA requirements will be processed and applied to fabrication as a standalone activity, subpart of a construction contract, or a design fabrication activity. Requirements will be incorporated into the subcontracts and will apply to lower-tier subcontractors and suppliers. QA requirements for items and work activities subject to 10 CFR 830, Subpart A, “Quality Assurance Requirements,” will be communicated to personnel, supplier, and lower-tier subcontractors.

  NQA-1 documentation requirements for safety-significant work during fabrication and installation are independently verified by an Independent Qualified Registered Professional Engineer, WRPS, and ORP. The independent verification documentation is defined in a quality assurance inspection plan (QAIP) during design, and approved as part of the contract approval process. The QAIPs, developed by Engineering and Quality Assurance, require inspections based on performance process criteria, which include supporting work processes, design and engineering acceptance criteria, procurement requirements, and inspection and acceptance testing.

These criteria provide assurance that work is performed using approved procedures and consistent with technical standards, administrative controls, and hazard controls to meet contractual or regulatory commitments. Source verification and receiving inspections of permanent plant material and items are conducted by quality representatives to ensure that the supplied material and items meet the requirements, as specified in the QAIPs.

14.0 INTERFACE AND COMMUNICATIONS

Several stakeholders will serve important roles in WFD preparation and operations. A cooperative yet disciplined interface process will be needed. Key stakeholders include DOE, Hanford contractors (including WTP, Plateau Remediation Contractor, and MSA), regulatory and oversight organizations, advisory groups, and the public. The process for conducting formal interfaces is governed by TOC implementing plans and procedures, as outlined in TFC-PLN-84. In addition, project-specific interface approaches to WFD will be established to ensure proactive communications and early resolution of issues. Key stakeholder interfaces are outlined in Table 14-1. WRPS resources will be needed to provide the identified interfaces and are included in the PMB project management account.

Table 14-1. Key Stakeholder Interfaces (2 pages)

Stakeholder	Interfaces	WFD-specific approach
U.S. Department of Energy		
DOE Headquarters	Support ORP interactions with DOE Headquarters (i.e., data, reporting, deliverables, and approvals)	As-requested interface support provided by project manager
DOE ORP	ORP WFD Federal Project Director IPT	• Tank farms projects • WFD • SST retrieval
	EPCC project date, reporting, deliverables, and approvals	Graded approach outlined in the PEP project tailoring checklist for each individual tank farm upgrade project produced when project needs vary from the WFD checklist
	EPCC project status and issues resolution	Weekly status reports, schedule updates, and interface meetings held with the ORP Federal Project Director or delegate
	Readiness	Confirm project readiness and WTP feed readiness
	Operations oversight	Respond to oversight through IPT
Other Hanford Contractors		
WTP	ICD negotiations, readiness integration	Sub-CLIN 3.1 WTP ICD process, and sub-CLIN 3.2 role (One System)
CH2M HILL Plateau Remediation Company	Waste forecasts, waste acceptance, shipment coordination	ICDs and statements of work
Mission Support Alliance	• Crane • Rigging • Electrical utilities upgrades to support SST retrieval and WFD • Other site services support (e.g., water)	• ICDs and statements of work • Interface management between ORP, Mission Support Alliance, and WRPS

Table 14-1. Key Stakeholder Interfaces (2 pages)

Stakeholder	Interfaces	WFD-specific approach
Regulatory and Oversight Organizations		
Defense Nuclear Facilities Safety Board	Information requests, document reviews, and briefings	Provide information as requested
Ecology	Project status briefings, permit approvals, site inspections	RCRA modification request Notice of construction
WDOH	Permit approvals, site inspections	Notice of construction Submit, if required, water connection modification plans

CLIN	=	contract line item number.
DOE	=	U.S. Department of Energy.
Ecology	=	Washington State Department of Ecology.
EPCC	=	engineering, procurement, construction, and commissioning.
ICD	=	interface control document.
IPT	=	integrated project team.
ORP	=	U.S. Department of Energy, Office of River Protection.
PEP	=	project execution plan.
RCRA	=	Resource Conservation and Recovery Act.
SST	=	single-shell tank.
WDOH	=	Washington State Department of Health.
WFD	=	waste feed delivery.
WRPS	=	Washington River Protection Solutions, LLC.
WTP	=	Waste Treatment and Immobilization Plant.

15.0 PROJECT TURNOVER AND CLOSEOUT

The IWFD equipment and infrastructure upgrades will be completed in discrete projects and will be turned over to the Operations organization as the upgrades for each tank farm are completed. The turnover and closeout of each project will be governed and tailored in accordance with the process described in TFC-PRJ-PM-C-02, Section 4.5; TFC-PLN-72; and the Project Roadmap, a module in the Project Navigator System.

15.1 PROJECT TURNOVER

A project turnover scoping document will be initiated during the conceptual design phase and issued prior to the completion of final design. This document is developed in accordance with TFC-PRJ-PM-C-28. The deliverables and completion criteria will be identified in the project turnover scoping document. A project turnover document will be developed and deliverables compiled based on the checklist of the project turnover scoping document. The project turnover document will be signed off as it is completed and the acceptance authority is satisfied with the deliverables at the completion of each project. Any items not completed will be identified as a punchlist item, have a responsible person assigned, funding identified, and delivery dates agreed-to prior to closeout. The Operations organization has the final approval on the project turnover document, signifying that the products and deliverables identified in the project turnover scoping document were either completed or documented on the closeout punchlist.

15.2 PROJECT CLOSEOUT

The project closeout phase begins following the completion of construction. The closeout phase includes the following activities and deliverables:

- Reassign project staff; reassignment will be staggered to align the level of the project staff with the remaining work
- Closeout project files; release revised facility drawings into the Hanford document control system
- Compile lessons-learned[17] documents and place in IDMS (integrated document management system)
- Close contracts with subcontractors in accordance with business management processes
- Close project control accounts and control account charging numbers in accordance with TFC-BSM-AC-C-06, *Finance Functions*.

A project closeout report will be prepared and issued in accordance with TFC-PRJ-PM-C-28.

[17] Lessons-learned sessions should be performed throughout the life-cycle of a project in accordance with TFC-OPS-OPER-C-28, *Lessons Learned*.

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16.0 OPEN ISSUES AND PENDING DECISIONS

The project plan updates the life-cycle plan to complete WFD to the WTP or other treatment systems that may be selected in the future. This plan is developed to respond to evolving strategies and RPP mission needs as tank waste treatment is optimized.

Table 16-1 provides a summary of key open issues and remaining decisions identified during the development of this project plan, and the planned approach to achieve resolution.

Table 16-1. Integrated Waste Feed Delivery Open Issues and Pending Decisions (3 pages)

Issue (I)/ Decision (D)/ Opportunity (O)	Description	Tables 12-1 and 12-2 reference	Resolution plan
I2 RPP mission analysis	Significant changes have occurred in recent years in the overall strategy for tank waste treatment, including cancellation of initiatives (e.g., interim pretreatment system) and implementation of new initiatives (e.g., One System). A final decision regarding disposition of CH-TRU waste has not been made. An updated mission analysis is needed to optimize the integrated waste disposition flowsheet, and this process may affect WFD strategies.	S-1, S-7	Optimization of the IWFDP strategy will be included in future revisions of the IWFDP PEP and TOC PMB.
I3 Determination of IWFD system instrumentation needs	Instrumentation to support measurement of mixing, retrieval, tank waste characterization, and system operational parameters for WFD is not determined at this time. The need for real-time monitoring equipment may alter planning and design assumptions. WFD planning maturity is needed before instrumentation selection can be finalized.	CR1, CR2, CR3, OSS-1, and OPP-7	Instrumentation studies will be planned in future years following further development of the RPP mission analysis (I2), update of 24590-WTP-ICD-MG-01-019,[a] and completion of small-scale mixing/sampling demonstrations. Provisions for future studies were included in the PMB.
O1 IWFD system operational modeling and performance analysis	Planning and design of the IWFD systems will benefit from development of an OR model and completion of a RAMI analysis.	S-21, S-23, OG-4, OSS-2	The OR model and RAMI analysis were identified as a work acceleration opportunity. The third of four planned modeling phases was completed in November 2011.

Table 16-1. Integrated Waste Feed Delivery Open Issues and Pending Decisions (3 pages)

Issue (I)/ Decision (D)/ Opportunity (O)	Description	Tables 12-1 and 12-2 reference	Resolution plan
O2 DST closures integration	The IWFD system was developed to optimize WFD to the WTP. Integration with subsequent DST closure operations was considered in the planning. However, improvements to WFD planning and design will benefit from further evaluation and development of DST closure integration.	OPP-1	A DST closure integration value engineering study will be performed during the design of the IWFD project AW Farm upgrade. It is anticipated that retrieval planning and IWFD projects definition will be sufficiently advanced to support integration analysis at this time.
O3 Accelerate tank waste treatment	It is anticipated that as WTP facility construction advances, opportunities will be identified to accelerate commissioning and initiation of treatment operations.	S-7, S-20, OPP-5	The sub-CLIN 3.2, WTP support interface team will monitor for developing treatment acceleration opportunities and work closely with WFD and DST upgrades to implement any DOE-authorized activities to accelerate tank waste treatment. The 2020 Vision One System initiative is being implemented to accelerate and optimize commissioning and initiation of treatment operations.
D2 Tank waste pretreatment	The current cost and planning baseline and System Plan (Rev. 6)[b] have Envelope C pretreatment occurring in the tank farms—strontium and TRU precipitation, specifically for Tank AN-102 and AN-107 supernate—prior to WTP transfer. This pretreatment involves the addition of strontium nitrate and sodium permanganate to the supernate, forcing precipitation of ^{90}Sr and key TRU elements. Additionally, consideration is being given to performing some leaching of precipitated aluminum in the DST system.	S-24, CR-1, CR-2, CR-3, CR-5	Development testing is needed to develop requirements for the precipitation process. The current evaluation (RPP-RPT-48340[c]) assumes the precipitation process will be performed in-tank. No significant tank farms infrastructure modifications are anticipated. If future studies demonstrate a significant benefit from in-tank leaching, RPP-24808[d] will be updated to establish scope, cost, and schedule to implement.
I4 TPA[e] milestones	Renegotiated TPA[e] milestones may be associated specifically with planning and construction of the IWFD system.	SR-3	Reevaluate the project plan if and when new TPA[e] milestones are available.

Table 16-1. Integrated Waste Feed Delivery Open Issues and Pending Decisions (3 pages)

Issue (I)/ Decision (D)/ Opportunity (O)	Description	Tables 12-1 and 12-2 reference	Resolution plan
I5 DST solid levels are greater than 300 in.	SST retrievals are driving DST solid levels above the established DST targets of 200 to 250 in. of solids.		Evaluate new DST retrieval technologies that can move and mobilize solids when the solids level is above 300-in. in DSTs (i.e., employ mixer pumps with incremental lowering capability).
I6 Tank erosion and components issue	Erosion of tank floor and mixer pump internal components may degrade performance or cause premature failure.		Conduct studies to evaluate the impact of mixer pump erosion.

[a] 24590-WTP-ICD-MG-01-019, 2008, *ICD 19 – Interface Control Document for Waste Feed*, Rev. 4, Bechtel National, Inc., Richland, Washington.

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CH-TRU = contact-handled transuranic.
CLIN = contract line item number.
DOE = U.S. Department of Energy.
DST = double-shell tank.
EPA = U.S. Environmental Protection Agency.
IWFD = integrated waste feed delivery.
IWFDP = Integrated Waste Feed Delivery Plan.
OR = operations research.
PEP = project execution plan.
PMB = performance measurement baseline.
RAMI = reliability, availability, maintainability, and inspectability.
RPP = River Protection Project.
SST = single-shell tank.
TOC = Tank Operations Contract.
TPA = Tri-Party Agreement.
TRU = transuranic.
WFD = waste feed delivery.
WTP = Waste Treatment and Immobilization Plant.

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APPENDIX A

GLOSSARY

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Term (abbreviation)	Definition or expansion
Baseline Case	In System Plan (Rev. 6),[a] the Baseline Case is a mission scenario that forms the technical basis for both the near-term baseline and the out-year planning estimate range.
Blind Blending	Intentional blending of high-level waste (HLW) feed based solely on the availability of waste.
Buoyant-Displacement Gas Release Event (BDGRE)	Tank waste generates flammable gases through the radiolysis of water and organic compounds, thermolytic decomposition of organic compounds, and corrosion of the carbon steel tank walls. Under certain conditions, this gas may accumulate in a settled solids layer until the waste becomes hydrodynamically unstable (less dense waste near the bottom of the tank). A BDGRE is the rapid release of this gas, partially restoring hydrodynamic equilibrium. The release may result in the temporary creation of a flammable mixture in the headspace of the tank, depending on the size of the release relative to the capacity of the ventilation system.
Complexed Concentrate	The term used for wastes with organic chelating agents that were used during strontium recovery operations at B Plant in the 1960s and 1970s. Waste was considered to be complexed concentrate if the total organic carbon concentration exceeded 10 g/L after concentration. Complexed concentrate has the potential to maintain strontium and transuranic elements in solution, requiring additional pretreatment steps prior to treatment and disposal. Tanks AN-102 and AN-107 are identified as complexed concentrate waste.
Cross-Site Transfer	The Hanford waste tanks are located in two physically separated areas called the 200 East Area and 200 West Area, about seven miles apart. The cross-site transfer system includes transfer pipelines and ancillary equipment that is used to transfer supernate and slurry from the 200 West Area to the 200 East Area.
Disposal	Emplacement of waste in such a manner that ensures protection of the public, workers, and the environment with no intention of retrieval and that requires deliberate action to regain access to the waste (per DOE M 435.1-1[b]).
Enabling Assumption	An issue that results in an assumption that allows (enables) the planning to continue until the issue is resolved. This enabling assumption is a statement of the most reasonable or likely path forward on an issue and/or area of project uncertainty.
Envelope C	Tank waste that contains complexed concentrate, limited to Tanks AN-102 and AN-107.
Group A Tanks	Tanks that, due to their waste composition and quantities, have the potential for a spontaneous BDGRE and are conservatively estimated to contain enough flammable gas within the waste that if all were released into the tank headspace, the concentration of the flammable gas would be a flammable mixture.
High-Level Waste (HLW)	The fraction of the tank waste containing most of the radioactivity that will be immobilized into glass and disposed at an off-site repository. HLW includes the solids remaining after pretreatment plus certain separated radionuclides.
High-Level Waste (HLW) Feed	The slurry stream (sludge plus supernate) that is delivered to the Waste Treatment and Immobilization Plant (WTP) Pretreatment Facility. Any solids remaining after pretreatment are routed to the WTP HLW Vitrification Facility along with separated radionuclides.
Hanford Tank Waste Operations Simulator (HTWOS)	A dynamic event-simulation model that tracks waste as it moves through storage, retrieval, feed staging, and multiple treatment processes from the present day until the end of the River Protection Project (RPP) mission.
Hot Commissioning	The phase in which WTP does production runs using actual tank waste.

Term (abbreviation)	Definition or expansion
Incidental Blending	Blending of HLW feed that naturally occurs during the retrieval, staging, storage, and delivery of feed without any special effort other than single-shell tank (SST) sequencing. It is sometimes called unavoidable blending.
Integrated Waste Feed Delivery System (IWFD system)	System made up of smaller projects called IWFD projects. It is the system that will support the timely delivery of feed to the WTP throughout the RPP mission. This includes DST and all equipment installed by the IWFD projects.
Intentional Blending	Any blending that is specifically orchestrated and, therefore, requires additional effort. Examples include pairwise blending (blending of two tanks at a time), metered blending (where small amounts of a problematic waste are blended into a number of successive feed batches), and the blending of different wastes first segregated according to limiting constituents.
Low-Activity Waste (LAW)	Waste that remains following the process of separating as much of the radioactivity as practicable from HLW. This stream is transferred from pretreatment to the WTP LAW Vitrification Facility for treatment.
Low-Activity Waste (LAW) Feed	The liquid stream (supernate plus a small amount of entrained solids) that is delivered to the WTP Pretreatment Facility. LAW feed is managed as HLW until it has been pretreated.
Low-Level Waste (LLW)	Radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material, as defined in Section 11e.(2) of the *Atomic Energy Act of 1954*.[c] After treatment, low-level waste can be disposed in a near-surface facility.
Metered Blending	An intentional blending strategy that mixes small quantities (e.g., meters) of problematic wastes into successive feed campaigns.
Operating Scenario	The current RPP mission scenario that forms the technical basis for both the near-term baseline and the out-year planning estimate range. For this version of the IWFDP, the operating scenario is the System Plan (Rev. 6)[a] Baseline Case.
Project Execution Plan (PEP)	The U.S. Department of Energy's core document for management of a project, which establishes the policies and procedures to be followed to manage and control project planning, initiation, definition, execution, and transition/closeout, and uses the outcomes and outputs from all project planning processes, integrating them into a formally approved document. A PEP includes an accurate reflection of how the project is to be accomplished, resource requirements, technical considerations, risk management, configuration management, and roles and responsibilities.
Projectized Operational Activity (based on Category 2 projectized operational activity)	Expense-funded activities (medium complex to complex) consisting of relatively long duration (months to years) work, which require a focused amount of planning and coordination between multiple organizations to develop performance baselines and accomplish project objectives and goals. These activities generally involve relatively minor impacts on the facility safety basis. They can require design and construction, and a system startup. This category may require a management self-assessment/ readiness assessment to begin operations and includes traditional design/build projects that are no longer considered capital assets.
Retrieval	The process of removing, to the maximum extent practical, all of the waste from a given underground storage tank. The retrieval process is selected specific to each tank and accounts for the waste type stored and the access and support systems available. In accordance with OSD-T-151-00031,[d] a tank is officially in "retrieval status" if one of two conditions is met: (1) waste has been physically removed from the tank by retrieval operations, or (2) preparations for retrieval operations are directly responsible for rendering the leak or intrusion monitoring instrument out-of-service.

Term (abbreviation)	Definition or expansion
Saltcake	A mixture of crystalline sodium salts that originally precipitated when alkaline liquid waste from the various processing facilities was evaporated to reduce waste volume. Saltcakes are comprised primarily of the sodium salts of nitrate, nitrite, carbonate, phosphate, and sulfate. Concentrations of transition metals such as iron, manganese, and lanthanum and heavy metals (e.g., uranium and lead) are generally small. Saltcake typically contains a small amount of interstitial liquid. The bulk of the saltcake will dissolve if contacted with sufficient water.
Sludge	A mixture of metal hydroxides and oxyhydroxides that originally precipitated when acid liquid waste from the various reprocessing facilities was made alkaline with sodium hydroxide. Sludge is comprised primary of the hydroxides and oxyhydroxides of aluminum, iron, chromium, silicon, zirconium, and uranium, plus the majority of the insoluble radionuclides such as ^{90}Sr and the plutonium isotopes. Sludge typically contains a significant amount of interstitial liquid (up to nominal 40 wt% water). Sludge is mostly insoluble in water; however, a significant amount of aluminum and chromium will dissolve if leached with sufficient quantities of sodium hydroxide.
Slurry	The term slurry is used in several different contexts: • Slurry is a mixture of solids (e.g., sludge or undissolved saltcake) suspended in a liquid. For example, a slurry results when the sludge and supernate in a tank is mixed together. Slurries can be used to transfer solids by pumping though a pipeline. • Slurry can refer to the bottoms stream from the 242-A Evaporator or other evaporator streams. • Slurry also refers to a specific waste produced at Hanford that results from evaporating supernate originally removed from tanks containing saltcake so that aluminum salts begin to precipitate in addition to the sodium salts. This material, called “double-shell slurry” or “double-shell slurry feed” is present in the DSTs (specifically Tanks AN-103, AN-104, AN-105, and AW-101). For simplicity, this document will use the term “settled salts” or “saltcake” instead of slurry in this context.
Solids	The product of centrifuging the LAW feed, separating and drying the solids, and removing the dissolved solids contribution.
Success Criteria	Metrics that are used to determine how well a scenario meets overall mission goals or requirements, including schedule- and cost-based metrics.
Supernate	Supernate is technically the liquid floating above a settled solids layer. At Hanford, it is typically used to refer to any non-interstitial liquid in the tanks, even if no solids are present. Supernate is similar to saltcake in composition and contains many of the soluble radionuclides such as ^{137}Cs and ^{99}Tc.
Waste Feed Delivery (WFD)	Hanford waste currently stored at the tank farms that will eventually be transferred from the DSTs to WTP.
Waste Feed Delivery (WFD) System	RPP-47172[e] defines the WFD system as being composed of the DST system and the waste retrieval facilities (WRF); however, for the purposes of the IWFDP, WFD system is used to refer to those portions of the WFD system directly supporting preparation and delivery of waste feed to the WTP.

Term (abbreviation)	Definition or expansion
Waste Retrieval Facility (WRF)	A future facility used to support the retrieval of waste involving slurry transfers from SSTs that are located too far to be readily retrieved directly into a DST. The WRF, located near the SSTs, would accumulate and condition retrieved waste before transfer to a DST.

[a] ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U.S. Department of Energy, Office of River Protection, Richland, Washington.

[b] DOE M 435.1-1, 2011, *Radioactive Waste Management Manual*, Change 2, Office of Environmental Management, U.S. Department of Energy, Washington, D.C.

[c] *Atomic Energy Act of 1954*, 42 USC 2011, et seq.

[d] OSD-T-151-00007, 2011, *Operating Specifications for the Double-Shell Storage Tanks*, Rev. 7, Washington River Protection Solutions, LLC, Richland, Washington.

[e] RPP-47172, 2010, *Waste Feed Delivery System Description*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

APPENDIX B

SUMMARY OF PREVIOUS AND PRESENT INTEGRATED WASTE FEED DELIVERY-RELATED PROJECTS

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Table B-1 provides a summary of the scope of each of the following related previous and present IWFD projects and a summary of the scope completed by each project:

- Project W-058, Cross-site Transfer System upgrades
- Project W-151, Tank 101-AZ Waste Retrieval System
- Project W-211, Initial Tank Retrieval Systems
- Project W-314, Tank Farm Restoration and Safe Operations
- Project W-521, Waste Feed Delivery Systems
- Project E-525, DST Transfer System Modifications Project
- Transfer line upgrades project
- In-tank upgrades project
- Infrastructure upgrades project.

Table B-1. Previous Scope Summary of Related Integrated Waste Feed Delivery Projects (7 pages)

Project description (date)	Project workscope and actual work completed
W-058, Cross-site Transfer System (1990)	**Workscope**: Replacement of existing cross-site transfer lines (both slurry and supernate), which connects the 241-SY Farm at SY-A and SY-B valve pits in the 200 West Area to the 244-A lift station in the 200 East Area. • Piping that spans the above described run: – Two 3-in. stainless steel primary pipes in a 6-in. carbon steel encasement – Three diversion boxes and a high-point vent station complete with catch tank and pump and a low point sump and sump pump • Three booster pumps: one located in DB #1, another in vent station, and the third in DB #2 • Instrumentation and control: – Leak detection at low point of each transfer line encasement segment, at each DB drain or sump and vent station sump – A new PLC in 242-S Laboratory that allows integration of cross-site transfer control and pertinent tank farms transfer signals (e.g., pump shutdown) – New annunciators in 242-S Laboratory control room to alarm by location and alarm type • Electrical power – Two 13.8 kV-480Y/277V transformers at DB #1; each sized to carry entire load at DB #1 – Vent station shall be powered by existing utilities transformer – Normal distribution provided for other cross-site transfer system loads (e.g., 480Y/277 VAC 3-phase, 4-wire and 120/240 VAC single phase 3-wire). **Completed workscope**: • Installed piping run as described in scope summary. One of the two pipelines is designated as a slurry line, the other supernatant. Note that a subsequent project (W-314) bypassed the 244-A lift station and extended the cross-site piping to AN Farm (SN line to Tank AN-101, SL line to Tank AN-104). • Installed one diversion box (6241-A) and one vent station on transfer line route; diversion box and vent station have sumps with sump pumps. No catch tanks installed. • Installed two booster pumps in series inside DB 6241-A, on slurry line only • Installed instrumentation and control as described in scope summary • Installed electrical power as described in scope summary. Above installed equipment was tested prior to authorization to use. Pressure test of slurry line completed satisfactorily; booster pumps successfully run at time of installation. Use of slurry line not currently authorized, requiring a separate approval from DOE before commencement of slurry transfer operations. An activation evaluation[a] has been issued that describes the required needs, actions, and recommendations for the cross-site slurry transfer system to be operational.

Table B-1. Previous Scope Summary of Related Integrated Waste Feed Delivery Projects (7 pages)

<table>
<tr><th>Project description (date)</th><th>Project workscope and actual work completed</th></tr>
<tr><td>W-151, Tank 101-AZ Waste Retrieval System (1990)</td><td>Workscope: Mixing pumps and associated ancillary equipment for solids mobilization demonstration in 241-AZ-101. This included:
Two 300-hp mixer pumps
One new transfer pump and removed existing transfer pump
Four new profile thermocouple assemblies designed to withstand mixer pump forces and removal of the four existing thermocouple assemblies
Seven new drywell stiffener assemblies that contain new sludge thermocouples and removal of three existing sludge thermocouple assemblies
Three new erosion/stress measurement assemblies
Installing the new tank wall corrosion assembly
Raising and rotating the existing steam heater coil.
Completed workscope:
Installed two 300-hp mixer pumps
Transfer pumps not removed nor installed by Project W-151
Removed and replaced existing profile thermocouple assemblies; new profile thermocouple assemblies were outfitted with strain gauges
Installed seven new drywell stiffener assemblies and inserted six sludge thermocouples in drywells
Removed existing sludge thermocouple assemblies
Installed electrical distribution equipment in 241-AZ-156 building, including:
– Two transformers
– Two MCCs
– Two VFDs
Associated wiring
Heater coil was not raised and rotated; determined by analysis that it could withstand mixer pump forces</td></tr>
</table>

Table B-1. Previous Scope Summary of Related Integrated Waste Feed Delivery Projects (7 pages)

Project description (date)	Project workscope and actual work completed
W-211, Initial Tank Retrieval Systems (1994)	**Workscope**: Design, procurement, and installation of the following for Tanks AP-102, -104; AN-101, -102, -104, -107; AY-101, -102; AZ-101, -102, including: • Mixer pumps, except for AZ-101 (existing mixer pumps) and AN-107 (no sludge, no mixing required) • Transfer pumps • Operator stations that include functions to monitor, alarm, and control the retrieval system • Instrumentation required to support operation of the retrieval system, including instruments that must be replaced to withstand mixer pump forces • Interface with existing instrumentation that is necessary for safe mixing or transfer • Utilities for retrieval operations (electrical power, water, telecommunications, etc.) • Site preparation and tank modifications necessary for installation of WFD equipment • In-line or in-tank dilution capability • Flush capability to the transfer pump and piping • New jumpers in AP-02A and AP-02D pits • New piping connecting AP-02A and AP-02D pits • Pipelines from AP Farm to WTP interface point Provide mixing and pumping system for retrieval of waste from selected DSTs before design. **Completed workscope**: • Completed design of retrieval systems for Tanks AP-102, AP-104, AN-101, AN-104, AN-107, AY-102, AZ-101, and AZ-102 • Completed construction of:[b] – AN-101 pit jumpers, cover blocks, transfer pump and supporting infrastructure, mixer pump riser extension and pad – AP Farm control building modifications – AZ-156 control building modifications – AZ-101 pit jumpers – AN Farm utility infrastructure – AN, AY/AZ Farm dilution-flush system – Waste transfer piping from AP Farm to WTP interface point.

Table B-1. Previous Scope Summary of Related Integrated Waste Feed Delivery Projects (7 pages)

Project description (date)	Project workscope and actual work completed
W-314, Tank Farm Restoration and Safe Operations (1997)	**Workscope**: Upgrades to essential tank farms infrastructure that support WFD and correct environmental compliance deficiencies in tank farms support systems, including: • Tank farms instrumentation and MCS upgrades • Tank ventilation system upgrades • Waste transfer system upgrades • Electrical system upgrades. **Completed workscope**: • MCS[c] and instrumentation upgrades, including: – PLCs and/or HMIs in the following locations: Tanks AN-271, AP-271, AW-271, AZ-271 and AZ-702; 242-A Evaporator control room; MO-268 (200E HMI); 242-S and 252-S (SY Farm); and 219-S (222-S Laboratory) – Leak detection in various new and existing pits and pipelines – New valve position indicators • Tank ventilation system upgrades, including: – Primary tank vent systems on AN and AW Farms upgraded to higher capacity systems; MCCs upgraded to suit – In-kind replacement of SY Farm annulus vent system – Fabrication on AP Farm tank inlet stations • Waste transfer system upgrades, including: – New inter- and intra-farm waste transfer piping and cathodic protection to suit – AZ valve pit, AN-04D encasement valve box – Pit drain seals – New jumper manifolds – Pit protective coatings – Extension of the cross-site transfer lines to AN-104 (slurry line) and AN-01A pit (supernatant line) – Cross-site transfer lines were routed out of the 244-A lift station and connected to AN Farm • Electrical system upgrades, including: – New MCCs in AY and AZ Farms – Spare main circuit breakers for the AN and AW Farms.

Table B-1. Previous Scope Summary of Related Integrated Waste Feed Delivery Projects (7 pages)

Project description (date)	Project workscope and actual work completed
W-521, Waste Feed Delivery Systems (1999)	**Workscope**: Upgrades to Tanks AW-101, -103, -104; AY-101, -102; SY-101, -102 and -103 SSCs necessary to assure successful and reliable waste feed to the WTP, including: • Mixer pumps for sludge mobilization • Transfer pumps • Instrumentation required to support operation of retrieval systems, including instruments that must be replaced to withstand mixer pump forces • Equipment containers for removal and eventual burial of existing in-tank components • Utilities for retrieval operations (electrical power, water, telecommunications, etc.) • In-line or in-tank dilution capability • Flush capability to the transfer pump and piping • Transfer lines from the AP Farm to WTP interface point • New AP Farm valve pit • Upgrades to existing valve pits • Replacement of non-compliant in-farm transfer lines. **Completed workscope**: Completed conceptual design and advanced conceptual design. No procurements, no hardware installation. Note that some items in the Project W-521 scope were ultimately moved to and completed by other projects (e.g., the new transfer lines from AP Farm to the WTP interface point were installed by Project W-211) or alternate solutions were found (e.g., DST-to-WTP waste transfer lines were routed through 241-AP-02D pit by Project W-211 instead of building a new AP valve pit). Other items were deferred, such as replacements of non-compliant in-farm transfer lines.
E-525, DST Transfer System Modifications Project (2003)	**Workscope**: Five design packages for compliant waste transfer capabilities in support of operation of the DST farms, the retrieval process, and the delivery of waste to WTP, including: • 241-AZ-151 catch tank replacement/bypass • COB modifications • SY transfer line replacement with encasements extending through pit walls • 241-AR-204 transfer line encasement extension through building wall • Compliant transfer line between Plutonium Finishing Plant and 241-SY Farm. **Completed workscope**: • AZ-151 catch tank replacement/bypass completed with the exception of condensate distribution lines back to Tanks AZ-101, AZ-102, and AY-102 • COB modifications completed with the exception of modifications to COBs on 2–in. SL-168 between 242-A Evaporator and AW-A valve pit; modification of COB AW-9 not completed • New SY Farm transfer line spool pieces, nozzles, etc. procured (but not installed) • Transfer line encasement on 3-in. LIQW-702 was extended through the 241-AR-204 facility wall **Not completed/removed from the project scope:** • Blind flanges were placed on the wall flanges for HSW-202 and -203 waste transfer lines, thus prohibiting connections to these lines from the Plutonium Finishing Plant.

Table B-1. Previous Scope Summary of Related Integrated Waste Feed Delivery Projects (7 pages)

Project description (date)	Project workscope and actual work completed
W-566, Transfer Line Upgrades Project (2011)	**Workscope**: Upgrades of portions of Project E-525 not previously completed, including: • Condensate distribution lines back to Tank AZ-102 (Tank AZ-101was de-scoped) • COB modifications for COBs on 2-in. SL-168 between 242-A Evaporator and AW-A valve pit and one COB on SN-219 • Replacement of the following SY Farm transfer lines (SL-177/SN-277, SL-180/ SN-280, SN-278/SN-279, SN-285/SN-286, SN-700/701, SN-637) and the SY, AP, and AY/AZ Farm ventilation systems. **Completed workscope**: • Design and construction complete on condensate distribution lines • COB modifications complete • Design and construction complete on all SY Farm waste transfer lines • Startup and readiness deferred until WTP startup is authorized.
In-Tank Upgrades Project (2009)	**Workscope**: Upgrades to each DST for in-tank equipment required for WFD, including: • Mixer pumps for waste mobilization and suspension • Transfer pumps • Support equipment needed for operating and monitoring WFD equipment (e.g., vertical indexing devices for mixer pumps, jumpers to connect WFD transfer pumps to DST waste transfer piping, and instrumentation to measure waste flow, pressure, density, temperature, other physical characteristics) • Associated DST modifications (e.g., pit cover blocks) • Removal of existing in-tank equipment required for installation/operation of above ITU equipment. **Completed workscope**: • Hanford submersible mixer pump procurement specification (RPP-SPEC-43262[d]) completed • Mixer pump design completed, Tank AY-102 • In-tank upgrade 30% design completed • Tank AY-102 ITU 30% design complete.
Infrastructure Upgrades Project (2009)	**Workscope**: Upgrades to infrastructure in each DST farm for WFD activities, including: • Electrical service upgrades – AP, AW, AY, AZ, and SY Farms • Utility runs to tanks (e.g., electrical power, water, instrumentation/network wiring, etc.) – AN (except AN-101), AP, AW, AY, AZ (except AZ-101), SY Farms • ICE building – AW and AY/AZ Farms • In-line/in-tank dilution and transfer pump/piping flush capability for AW and AY/AZ Farms. **Completed workscope**: 100% design complete for AW and AY/AZ Farm infrastructure upgrades, including electrical service upgrades, utility runs to tanks, ICE building, and diluents/flush system. Design complete for AY/AZ Farm electrical service upgrade and ICE building (CLIN 1).

Notes to Table B-1.

[a] RPP-RPT-47572, 2012, *Cross-Site Slurry Line Evaluation Report*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

[b] With the exception of AN, AY/AZ Farms dilution-flush system, this equipment has been installed and turned over for maintenance only, not for operation. AN, AY/AZ Farms dilution-flush system has been installed but not turned over to the Operations organization.

[c] Project W-314 MCS upgrades installed; however, only monitor function of MCS is turned over and operational. Control function not yet turned over for operation.

[d] RPP-SPEC-43262, 2011, *Procurement Specification for Hanford Double-Shell Tank Submersible Mixer Pumps*, Rev. 3, Washington River Protection Solutions, LLC, Richland, Washington.

CLIN	=	contract line item number.	ITU	=	in-tank upgrade.
COB	=	cleanout box.	MCC	=	master control console.
DB	=	diversion box.	MCS	=	monitoring and control system.
DOE	=	U.S. Department of Energy.	PLC	=	programmable logic controller.
DST	=	double-shell tank.	SSC	=	structures, systems, and components.
FY	=	fiscal year.	VFD	=	variable frequency drive.
HMI	=	human-machine interface.	WFD	=	waste feed delivery.
ICE	=	instrumentation, control, and electrical.	WTP	=	Waste Treatment and Immobilization Plant.

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APPENDIX C

STUDIES RELEVANT TO THE INTEGRATED WASTE FEED DELIVERY PROJECTS

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Table C-1 provides a list of studies and work performed to support previous and present waste feed delivery (WFD) activities. These studies provide relevant background information associated with applicable integrated waste delivery (IWFD) project designs and their bases. Specifically, documents that contain any of the following are listed in Table C-1:

1. Design media that represents the latest generation of equipment design for evaluation/utilization on the IWFD projects
2. Technical basis information on WFD double-shell tank (DST) system/equipment design
3. Technical basis information on the WFD DST system configuration
4. Recommendations on improvements to existing designs that should be revisited on commencement of IWFD projects
5. Historical information useful to IWFD projects initiation.

Documents pertaining to the existing DST system configuration and status (i.e., designs completed and installed by previous DST upgrades projects) are addressed in Section 4.0.

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
Project W-151 Documents		
RPP-6548, *Test Report, 241-AZ-101 Mixer Pump Test*, Rev. 1 (2), (3)	9/2001	Documents mixer pump test conducted in Tank AZ-101 during FY 2000. The purpose of the test was to demonstrate that the two 300-hp mixer pumps installed in Tank AZ-101 could mobilize and suspend the settled sludge therein. The report addresses mixer pump operating requirements, sludge mobilization and suspension, and data acquisition equipment performance. The testing conducted increases confidence that the two 300-hp mixer pump configuration will safely mobilize sludge in DSTs.
WHC-SD-W151-ANAL-001, *Structural Evaluation of Thermocouple Probes in 241-AZ-101 Waste Tank*, Rev. 0 (2), (5)	12/1994	Documents the structural analysis of the thermocouple probes installed in Tank AZ-101 for the mixer pump test. The thermocouple probes are analyzed for normal pump mixing operation and potential earthquake-induced loads required by Hanford Site design criteria SDC-4.1. The results of the analysis show that the thermocouple probes are good for both operating and extreme loading conditions. Recommendation is that if vortex shedding occurs as predicted, the rotational speed of the pump should be increased to 0.15 rpm to increase the fatigue life of the thermocouple probes.
WHC-SD-W151-DA-004, *W-151 Mixer Pump Energy Absorption Cylinder Analysis*, Rev. 0 (2), (5)	2/1996	Calculates the strength required for the energy absorption cylinder needed to prevent puncture through Tank AZ-101 resulting from a 59-ft. drop of the Project W-151 mixer pump. The crush strength of the impact limiter was calculated to be between 221 and 205 lbf/in^2. The configuration of the impact limiter can be found on drawing H-2-818723.[a]

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
WHC-SD-W151-ER-001, *Stress Cycles and Forces on In-tank Components Resulting from Mixer Pump Operation in DST 101-AZ (Design Input)*, Rev. 0 (2)	3/1993	Calculates the impact forces and the number of force cycles imparted to in-tank components by liquid streams for the nozzles of mixer pumps for both a two-pump system. As installed in Tank AZ-101 by Project W-151, and a potential four-pump system. Forces are derived from 1/6-scale model tests and analytical scaling to full size DSTs. The forces and cycles are recommended for use in detailed fatigue stress analysis calculations performed by others.
WHC-SD-W151-ES-003, *A Study of Methods for Assessing Tank AZ-101 Component Structural Integrity*, Rev. 0 (2)	6/1992	Study determines the best methods for characterizing the structural condition of the components before mixing begins. The study recommended that a thorough visual examination and some selected component wall thickness measurements would be adequate, but that visual examination during mixing would be needed to warn of incipient failure. Twenty different features that could lead to component failure were investigated. The conclusion was that fatigue, exacerbated by corrosion or stress corrosion cracking, was the most likely failure mode. Also, it was shown that the components could sustain large cracks or large reductions in wall thickness without failure, if the predictions of low loads are correct.
Project W-211 Documents		
WHC-SD-W211-ES-001, *Project W-211 Initial Tank Retrieval Systems Engineering Study*, Rev. 0 (2), (5)	10/1992	Initial Project W-211 engineering study to define large mixer pump WFD-DST system. This engineering study determines system capacities and requirements and identifies utilities and utility upgrades necessary to support the IWFD system. Much of the information regarding tank retrieval sequence/schedule is not valid at this time; however, the engineering study provides a historical reference of the fundamental concepts used for WFD-DST retrieval systems and the rationale for their selection.
WHC-SD-W211-TDR-001, *Supplement 2 to Title I Design Summary Report*, Rev. 0B (1)	11/1995	Supplement 2 is provided to update the conceptual design and document the Title I design for the ten tanks in the Project W-211 scope. The purpose of the report is to enable commencement of Title II design on any of the ten DST retrieval systems. The generic bounding design features of the DST retrieval system include mixer pumps with incremental lowering, a control building with portable power cables, and in-tank dilution. Also included are assessments of slab vs. pit-mounted mixer pumps, portable vs. permanent control buildings, and watch list vs. non-watch list tank requirements.

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
W211-C-GEN-003, *Project W-211 Calculation: Submersible Mixer Pump – Determination of Hydrodynamic Seismic Loads*, Rev. 1 (2), (5)	8/2006	Calculates loads imposed on an SMP installed in a DST as a result of the fluid motion induced from a seismic event. Several waste depths were evaluated to cover possible increases in allowable tank waste depth. Maximum sloshing loads on SMPs occurred for SMPs located at a radial distance of 22 ft and maximum waste depths.
W211-C-GEN-004, *Project W-211 Calculations: Submersible Mixer Pump – Jet Impingement Loads resulting from Mixer Pump Operations*, Rev. 1 (2), (5)	8/2006	Calculates loads imposed on a SMP immersed in DST waste and suspended from the foundation above the tank dome as a result of operating the other SMP installed in the same DST. Loads determined are a result of the cross-stream jet forces and associated cyclic load resulting from the induced shedding vortices. The loading on the SMP is described as a combination of a drag force and a time-dependent lift force, or as a static force of 950 lb along with the condition that the natural frequency of the SMP be outside 0.23–0.6 Hz to avoid resonance. Calculated loads shall be used in evaluation of the SMPs.
W211-INFR-P-003, *Project W-211 Calculation: Water Hammer Analysis*, Rev. 1 (2), (5)	3/2006	Calculates the sudden increase in pressure in the waste transfer system due to a rapid closure of a valve in the diluent/flush system as designed and installed by Project W-211. The operating pressure of the diluent/flush pump (CHEMB-P-002) is unknown and tracked as TBD-28956 throughout the calculation. Verification of this operating pressure is required to ascertain the total pressure experienced by the waste transfer system under rapid valve closure conditions.
W211-TP-P-005, *Project W-211, TP Calculations: W-211 Shielding Analysis for RPP/WTP Transfer Piping*, Rev. 2 (2)	8/2005	Dose rate calculation from a waste transfer pipe filled with waste at a concentration of 6 Ci of ^{137}Cs/gal, which “represents a bounding mixture for design of 67% liquid and 33% solid.” Pipe dimensions are 3-in. diameter, schedule 40 pipe inside a 6-in. diameter, schedule 40 pipe wrapped by 2-in. thick insulation. The soil depth cover to achieve dose rates <0.5 mrem/hr at 1 ft is calculated with ISO-PC code. Results show that 34 in. of common soil, as measured from the top of the pipe insulation, compacted to 110 lbf/ft^3 is sufficient to reduce dose rates to <0.5 mrem/hr at 1 ft.
Project W-314 Documents		
HNF-SD-W314-AGA-006, *244-A Double Contained Receiver Tank DCRT Utilization*, Rev. 0 (2)	2/1997	Documents the formal justification for taking the 244-A DCRT out of service and moving the cross-site transfer line termination point to AN Farm. It is a formal alternatives analysis, complete with decision plan, decision summary, and record of decision.

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
HNF-SD-W314-AGA-007, *"Alternative Generation and Analysis report, Tank Farm Monitoring and Master Pump Shutdown," Tank Farm Restoration and Safe Operation, W-314*, Rev. 0 (2)	7/1997	Documents the initial design basis for the type of system to be used for the upgraded tank farm monitoring and master pump shutdown system. A tank farms local area network system is selected as the preferred alternative to perform both the tank farm monitoring and master pump shutdown system functions. The tank farms local area network system architecture includes an engineering workstation, man-machine interfaces for data handling and operator interface, PLCs for data input and output and logic execution, and input and output boxes for field signals. Actual system characteristics, specifications, requirements, and expandability will be covered by specific project design documents.
HNF-SD-W314-TI-007, *Project Design Concept for Transfer Piping for Project W-314, Tank Farm Restoration & Safe Operations*, Rev. 4 (2), (3)	4/2002	Provides an overall description of the operations concept for the Project W-314 transfer piping system for Phases 1 and 2. In doing so, a system description and operations concept for the tank farms waste transfer system is documented along with the portions of the system envisioned to be upgraded by Project W-314. This summary description also provides a roadmap to the documents that provide the rationale for the system described (e.g., system assessment reports, upgrade scope summary reports, rebaseline report, etc.).
HNF-SD-W314-TI-008, *Project Design Concept – Master Pump Shutdown System*, Rev. 4 (2), (3)	8/2000	Provides an overall description of the concept for the Project W-314 master pump shutdown system for Phases 1 and 2. In doing so, a system description and operations concept for the tank farms master pump shutdown system, complete with a generic process description for tank farms waste transfers, is documented.
WHC-SD-W314-CDR-001, *Conceptual Design Report (CDR) for Tank Farm Restoration and Safe Operations, Project W-314*, Rev. 1 (1), (5)	11/1996	Reflects the conceptual design associated with the capital improvements to existing tank farms facilities (primarily DSTs) in the areas of instrumentation/control, ventilation, waste transfer, and electrical distribution. Rev. 0 of the CDR was approved in April 1996; Rev. 1 of the CDR reflects the modified set of priorities for performing the tank farms upgrades. Specifically, priorities include upgrades to support: • Tank waste disposal privatization initiative • Regulatory compliance to be completed no later than June 2005, in accordance with TPA milestone M-43-00 • Remaining Project W-314 scope to be completed by FY 2007.

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
WHC-SD-W314-ES-023, *Facility Assessment Summary Report for Project W-314, Tank Farm Restoration and Safe Operations*, Rev. 0 (2), (3)	6/1996	Provides an evaluation overview of the physical conditions and requirement for upgrading tank farms structures, systems, and components. The document addresses the evaluations, inspections, and assessments conducted on the tank farms associated with the preliminary Project W-314 scope, as represented in the original Project W-314 engineering studies, and provides requirements for specifying the necessary upgrades. Individual system assessments are referenced from the Facility Assessment Summary Report.
Project W-521 Documents		
RPP-6333, *Project W-521 Waste Feed Delivery System Conceptual Design Report(CDR)*, Rev. 0 (1)	12/2000	Contains the necessary technical, cost and schedule information to provide a sound basis for a cost range, and authorization and approval of the W-521 project baseline. Project W-521 scope includes upgrades to eight DSTs: AW-101, -103, and -104; AY-101 and -102; SY-101, -102, and -103. These DSTs were separated into three basic categories: • LAW source tanks – Upgrades include equipment to soften crusts, dissolve salts, and mobilize solids • HLW source tanks – Upgrades include equipment to mobilize and suspend solids • HLW staging tanks – Upgrades include equipment to mobilize, mix/blend, suspend solids, and transfer waste to the vitrification plant.
RPP-7069, *Project W-521, Waste Feed Delivery Systems, Advanced Conceptual Design Report*, Rev. 0 (1)	4/2001	Advanced conceptual design was aimed at resolving various uncertainties associated with the Project W-521 CDR. To resolve these uncertainties, 16 specific tasks were identified, which involved performing additional analysis and reviews and then determining if any of these enhancements will have an effect on the project cost and schedule. The ACDR for Project W-521documents these analysis, reviews, and delta project cost and schedule for these enhancements. The ACDR also incorporated various comments resulting from the CDR that were topical to the areas of uncertainty addressed.
Project E-525 Documents		
RPP-8925, *Double-Shell Tank Transfer System Modifications Project Preliminary Engineering Report*, Rev. 0 (2)	1/2002	Provides the basic definition of the scope and objectives for the start of the DST waste transfer system modifications project, which includes the isolation and removal from service non-compliant waste transfer system components. This document provides the basis used for generating the conceptual design. Some transfer system upgrades recommended in this document were accomplished by Project E-525, others were not. The IWFD projects should revisit this study and the WFD needs when scoping the transfer line upgrades.

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
RPP-10250, *Double-Shell Tank Transfer System Modifications Project E-525 Decision Summary*, Rev. 4A (2)	11/2005	Summarizes the evolution of the technical path forward for the five design activities within the Project E-525 scope of work. • 241-AZ-151 catch tank replacement/bypass • COB modifications • SY transfer line modifications • 241-AR-204 transfer line modifications • Compliant transfer line between Plutonium Finishing Plant and 241-SY Farm. Alternatives are discussed and the rationale/basis for the selected alternatives is given.
Waste Mixing/Mixer Pump Studies		
PNNL-13913, *Optimal Elevation and Configuration of Hanford's Double-Shell Tank Waste Mixer Pumps* (2), (3)	5/2002	Purpose of the report is to provide a technical evaluation of an alternate to the Project W-211 mixer pump configuration. The Project W-211 design is a bottom intake with jet nozzles approximately 17 in. above the bottom of the intake. The alternate design moved the pump intake above the jet nozzles. The authors analyze, using a 3D TEMPEST[b] computer simulation, varied jet nozzle heights above the tank bottom. Dramatic increases in sludge mixing were seen with jet nozzles between 0–6 in. above the tank bottom. The report provides a credible case for additional evaluation (cost, schedule, constructability, etc.) of the alternate mixer pump design.
PNNL-14763, *Feasibility Study on Using Two Mixer Pumps for Tanks 241-AY-102 Waste Mixing* (2), (3)	8/2004	Objective of this study was to determine if two rotating 300-hp jet mixer pumps located 22 ft from the center of the tank could adequately mix the Tank AY-102 waste (Tank AY-102 has a 62 in. sludge layer under 184 in. of supernatant liquid). Using a 3D TEMPEST computer simulation, it was determined that: • 89 vol% of the sludge was mobilized for a sludge shear strength of 1,090 Pa • 85 vol% of the sludge was mobilized for a sludge shear strength of 2,230 Pa. For both sludge shear strength cases, the bottom 2.5 in. of sludge (4 vol%) is not mobilized and is not expected to be mobilized with the addition of more mixer pumps. Additional mixer pumps will mobilize the shadow or wall effect sludge (height >2.5 in.) not mobilized in the two mixer pump configuration (an additional 7 vol% and 11 vol% for the 1,090 Pa and 2,230 Pa shear strength cases, respectively).
PNNL-17043, *Initial Investigation of Waste Feed Delivery Tank Mixing and Sampling Issues* (4)	10/2007	Summarizes the current state of knowledge concerning jet mixing of wastes in underground storage tanks. The report concludes that there is inadequate knowledge on what can be achieved in mixing and distribution of insoluble DST solids by use of the baseline SMP system. A combined mixing-sampling test program is recommended to fill this gap.

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
SRNL-STI-2009-00717, *Demonstration of Simulated Waste Transfers from Tank AY-102 to the Hanford Waste Treatment Facility*	11/2009	Objective of the study was to qualitatively demonstrate how well waste can be transferred out of a mixed DST and provide insights into the consistency between the batches being transferred. The work focused on visual comparisons of the results from transferring six batches of slurry from a 1/22-scale (geometric by diameter) mixing demonstration tank to six receipt tanks, where the consistency of solids in each batch were compared. It was found that changing the nozzle velocity of the mixer jet pumps had the biggest impact on the amount of solids transferred. Also, it was found that resuspending the solids in the mixing demonstration tank became less effective as the liquid level dropped in the mixing demonstration tank. Poor consistency of solids transferred in the final batch (sixth) was consistent throughout the tests conducted.
Tank Farm Transfer System Studies		
RPP-5346, *Waste Feed Delivery Transfer System Analysis*, Rev. 2 (2)	3/2002	Documents the basis for the required design pressure rating and pump pressure capacity of the Hanford tank farms waste-transfer system in support of WFD to the WTP Pretreatment Facility for processing. The scope of the analysis includes the 200 East Area DST waste transfer pipeline system and the associated transfer system pumps for all Phase 1B and Phase 2 waste transfers from the AN, AP, AW, AY and AZ Farms. Waste transfers planned in support of the System Plan (Rev. 5)[c] use the same transfer piping system analyzed in this document.
RPP-9805, *Values of Particle Size, Particle Density and Slurry Viscosity to Use in Waste Feed Delivery Transfer System Analysis*, Rev. 1A (2)	3/2002	Documents the development of recommended values for particle size distribution, particle density, and slurry viscosity that may be used in slurry flow calculations. These calculations support the design of the waste transfer piping system that is to be used to deliver Hanford waste from the DSTs to the WTP for treatment.
Tank Farm Primary Ventilation System Studies		
RPP-RPT-27845, *Evaluation of 241-AZ-702 Ventilation System Capacity for Mixer Pump Operation*, DRAFT (2)	10/2005	Evaluates existing 241-AZ-702 ventilation system capacity against waste storage and mixing/waste feed requirements and identifies equipment repairs/upgrades necessary to ensure these requirements are met. Recommendations include: • AY-101, -102, and AZ-102 condensers should be resized to ensure heat removal generated by waste and operation of two mixer pumps • Evaluate modifications necessary to achieve a total stack flow of 2,200 scfm so that two tanks in the AY/AZ Farms could be cooled sufficiently while operating mixer pumps • Further evaluate, via dynamic modeling, heat-up and cool-down rates during various mixer pump operations and tank farms operating configurations.

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
RPP-7171, *Thermal Hydraulic Evaluation for 241-AN Tank Farm Primary Ventilation System*, Rev. 1 (2)	10/2007	Documents the thermal hydraulic analysis performed for the 241-AN primary tank ventilation system installed by Project W-314. Analysis shows adequate ventilation system capacity during DST waste retrieval activities under various farm configurations/operating scenarios except for Tank AN-107. Inlet air flow at Tank AN-107 is limited to 400 acfm through the 4-in. inlet air riser and does not reach the required 500 acfm to cool the waste at maximum waste temperatures. The recommendation is to relocate the inlet air station to a 12-in. riser to get the required 500 acfm inlet flow. The document also shows that adequate vacuum relief for entire farm is achieved at Tanks AN-101 and -102, if the exhaust isolation valves for these tanks are disabled to prevent isolation of these tanks from the ventilation system exhaust header.
RPP-11731, *Thermal Hydraulic Evaluation for 241-AW Tank Farm Primary Ventilation System*, Rev. 1 (2)	7/2008	Documents the thermal hydraulic analysis performed for the 241-AW primary tank ventilation system installed by Project W-314. The analysis shows adequate ventilation system capacity during DST waste retrieval activities under various farm configurations/operating scenarios. It also shows that adequate vacuum relief for the entire farm achieved at Tanks AW-104 and -106, if the exhaust isolation valves for these tanks are disabled to prevent isolation of these tanks from the ventilation system exhaust header.
RPP-43971, *SY Vent System Thermo-Hydraulic Analysis*, Rev. 0 (2)	3/2010	Documents thermal hydraulic analysis of the 241-SY Farm primary ventilation systems to evaluate the ventilation system performance for future normal and waste retrieval operations, and demonstrate that the planned upgraded primary ventilation system is fully functional for future retrieval operations and meets applicable design functions and requirements.
RPP-45912, *AP Vent System Thermo-Hydraulic Analysis*, Rev. 0 (2)	2010	Documents thermal hydraulic analysis of the 241-AP Farm primary ventilation systems to evaluate the ventilation system performance for future normal and waste retrieval operations, and demonstrate that the planned upgraded primary ventilation system is fully functional for future retrieval operations and meets applicable design functions and requirements.
RPP-49579, *Thermal Hydraulic Evaluation For 241-AY and 241-AZ Tank Farm Primary Ventilation System*. Rev. 0	2010	Documents thermal hydraulic analysis of the 241-AY and AZ Farm primary ventilation systems to evaluate the ventilation system performance for future normal and waste retrieval operations, and demonstrate that the planned upgraded primary ventilation system is fully functional for future retrieval operations and meets applicable design functions and requirements.

Table C-1. Waste Feed Delivery-Double-Shell Tank Studies (9 pages)

Document no. and title	Date	Content summary
RPP-46864, *Thermal Evaluation for High Level Waste Feed Interface Temperature Criterion*, Rev. 0	2010	Evaluates the thermal behavior of Tank 241-AY-102 during HLW feed delivery to determine if the new 150°F temperature criterion for the HLW transfer to the WTP can be met. The evaluation was done using a thermal model that predicted the ventilation flow rate needed to keep the temperature of the waste transfers below the criterion.
Tank Farm Infrastructure Studies		
RPP-5227, *Waste Feed Delivery Raw Water, Potable Water and Compressed Air Capacity Evaluation*, Rev. 1 (2)	2/2010	Documents an evaluation of existing and projected raw water, potable water, and compressed air requirements from all users during the IWFD system activities. The capability of the existing systems to meet these needs is also evaluated. Assessment of the cumulative raw water, potable water, and compressed air requirements in terms of quality, and the flowrate needed to support upcoming activities of all known users, is provided. The timeframe for which the evaluation is conducted spans the years 2009 to 2030.
RPP-5228, *Assessment of the Electrical Power Requirements for Continued Safe Storage and Waste Feed Delivery*, Rev. 1 (2)	2/2010	Documents an evaluation of existing and projected tank farms electrical service and distribution needs. Existing needs were gathered from electrical utilities' metered data between 2007 and 2009. Projected needs were calculated based on DST WFD and SST retrieval assumptions consistent with ORP-11242 (Rev. 4)[d] (see SVF-1805, Rev. 0[e]). Current tank farms electrical service and distribution capabilities are compared to the projected need with recommendations for upgrades to the system configuration, where required.

[a] H-2-818723, 1994, "Tank AZ-101 Energy Absorption Cylinder Assembly," Westinghouse Hanford Company, Richland, Washington.

[b] TEMPEST is a trademarked product of Tempest Software of New York, New York.

[c] ORP-11242, 2010, *River Protection Project System Plan*, Rev. 5, U.S. Department of Energy, Office of River Protection, Richland, Washington.

[d] ORP-11242, 2009, *River Protection Project System Plan*, Rev. 4, U.S. Department of Energy, Office of River Protection, Richland, Washington.

[e] SVF-1805, 2010, "Elect. Pwr Needs for WFD & SST Retrieval, Rev.0.xlsx," Washington River Protection Solutions, LLC, Richland, Washington.

ACDR	=	advanced conceptual design report.	LAW	=	low-activity waste.
CDR	=	conceptual design report.	PLC	=	programmable logic controller.
COB	=	cleanout box.	RPP	=	River Protection Project.
DCRT	=	double-contained receiver tank.	SMP	=	submersible mixer pump.
DST	=	double-shell tank.	SST	=	single-shell tank.
FY	=	fiscal year.	TPA	=	Tri-Party Agreement.
HLW	=	high-level waste.	WFD	=	waste feed delivery.
IWFD	=	integrated waste feed delivery.	WTP	=	Waste Treatment and Immobilization Plant.

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APPENDIX D

PROPOSED STRATEGIES

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Table D-1. Proposed Strategies Supporting Technical Baseline (6 pages)

Study	Purpose	Scope
Support resolution of 24590-WTP-ICD-MG-01-019[a] sampling requirements issue	Support joint task force to reconcile feed certification requirements between the Tank Operations Contractor and WTP approaches identified by (TOC-12-64 and TOC-08-65).	Provide support and incorporate into decision process for feed characterization outside DST farms.
Evaluate feasibility of piping loop to satisfy interface control physical property and limited chemical criteria	24590-WTP-ICD-MG-01-019[a] suggests the installation of a piping loop in the IWFD system to demonstrate that waste transfer properties conform to interface acceptance criteria as an alternative to waste sample analysis and critical velocity calculations. The purpose of this study is to investigate the feasibility of including the flow and chemical property measurement concept in the WFD technical basis. The approach also has potential to satisfy the recommendation proposed by the DNFSB (2002)[b] and eliminate a proposed test by performing instrumented transfer on a routine basis.	Prepare a feasibility study that confirms data obtained from a flow loop can be used to satisfy the interface criteria requirements, identifies the number of flow loops required to support ORP-11242 (Rev. 6)[c] flow loop location, assesses the potential impact on transfer equipment, and estimates implementation cost.
Review SST retrieval transfers for potential waste transfer property data	Determine whether recent transfer data provides insight that can be used to confirm waste transfer property predictions. Confirm that transfer data provided by the proposed control system is sufficient to support WFD requirements or identifies gaps in proposed instrumentation.	Prepare document describing recent transfer data and analyze results to indicate potential applicability to future transfers.
Review basis for Environmental Simulation Program calculations used to prepare material balances	Review Environmental Simulation Program library used to predict WFD material balances. In 1999, HNF-1939[d] indicated that Environmental Simulation Program's database may not possess the appropriate solid-phase chromium species to model chromium behavior properly. This caveat has been retained in RPP-8218.[e] Supports preparation of updated waste batch-specific material balances in flowsheets.	Establish a baseline Environmental Simulation Program library to be used for performing WFD material balances and place under configuration control. Resolve issues with chromium species.

Table D-1. Proposed Strategies Supporting Technical Baseline (6 pages)

Study	Purpose	Scope
Perform general update of WFD flowsheet	Incorporate study results that have been obtained since 2001 into the flowsheet bases and update waste-batch specific material balances	Update RPP-40149, Volumes 1 and 2,[f] as necessary. Revise RPP-8218: [e] • Update basis for settling calculation. Settling prediction in RPP-8218[e] based on HNF-5177.[g] The Tank AZ-101 mixer process test (RPP-6548[h]) concluded that HNF-5177[g] calculation did not represent observations. This may be due to inaccurate estimates of Tank AZ-101 properties input to calculation or calculation development assumptions that do not approximate waste settling. • Revise critical flow velocity as part of a general revision to the flowsheet document. • Revise waste batch-specific material balances, starting with waste batches originating in Tank AY-102, adding additional batches as confidence in the process sequence develops. • Update basis for chemical, physical, and thermal considerations, incorporating studies that have been completed since 2001, as part of a general revision to the flowsheet document. • Update basis for process control parameters as part of a general revision to the flowsheet document. • Tank-specific flowsheets in HNF-1939[d] assume hydrogen generation rates from mixing Tank SY-101 bound hydrogen generation that may be experienced when degassing other DSTs (i.e., Tank AN-104). RPP-8218[e] does not include gaseous effluent release estimates. Add gaseous flows to RPP-8218[e] update that are appropriately bounding of the Group A tanks to be degassed. The Nuclear Safety and Licensing and Process Engineering/ Modeling organizations will provide the technical basis for setting these gaseous flow values.
Update process control strategy	The current version of RPP-11622[i] is based on an interim WFD strategy dated 1999 and contains many incomplete control sections that were deferred to be done at a later date.	Revise RPP-11622[i] and update deferred descriptions of logic and strategy.

Table D-1. Proposed Strategies Supporting Technical Baseline (6 pages)

Study	Purpose	Scope
Update induced environment basis for specifications	Update basis for chemistry, induced radiation, and waste properties as references for subsystem specifications. Ideally, this would be a common envelope for all DSTs to maintain flexibility throughout WFD operations.	• Update HNF-2937[j] • Update HNF-2004[k] • Update TFC-ENG-STD-34[l] • Waste properties currently would be covered by the update of RPP-5346[m] • Resolve design basis temperatures (HNF-4162[n] requires pump to move maximum 220°F waste; Project W-211 functional design criteria is 190°F). Resolve temperature specification to as low as practical.
Flush and diluent subsystem basis update	Confirm requirements for preheating flush water to establish system requirements for water heating. Ties to RPP-5346[m] enabling assumption that precipitation and crystallization are precluded during transfers for critical velocity analysis to be applicable and prevent line plugging assumption implicit in RPP-8218[e] discussion of transfer pipeline preheating.	• Update basis for line preheating requirement in RPP-8218[e] to identify that preheating protects the enabling assumption in RPP-5346[m] that no precipitation or crystallization occurs during a waste transfer for critical velocity analysis to be applicable. • Update references of HNF-4163[o] (e.g., still refers to HNF-1939[d]). • Evaluate risk of not providing backup power for transfer pumps and flush system pumps to mitigate pipe plugging on loss of normal power. HNF-4163[o] requires no addition of water or chemicals to tank during power failure.
Waste mixing basis update	Need definition of what constitutes: • Adequate mixing • Means to determine mixing effectiveness. Specify test for starting pump underneath dense waste. Confirm that pump meets rheology specifications for performance. Specify test of mixer pump. Predict mixer pump runtime to determine tank temperature rise (feeds into ventilation and waste transfer).	Included in tank mixing and sampling tests.

Table D-1. Proposed Strategies Supporting Technical Baseline (6 pages)

Study	Purpose	Scope
Sampling basis update	• Determine sampling strategy to meet operations, certified feed, and waste transfer requirements. • Develop waste sampling specification to implement sampling strategy and sample-handling requirements. • Develop sampling system concept and a test and development plan. • Provide verification turnaround time equivalent to 210 days for each DST staging tank for consistency with ORP-11242 (Rev. 6)[c] assumptions.	Integrate with mixing testing and incorporate into sampling and characterization facility decision process. Process waste sampling subsection specification (RPP-SPEC-47615[p]) has been issued.
Update specifications	Update TOC basis documentation.	All specifications have been updated including: • HNF-SD-WM-TRD-007[q] • HNF-4155[r] • HNF-4157[s] • HNF-4160[t] • HNF-4161[u] • HNF-4162[n] • HNF-4163[o] • HNF-4164[v]
Revisit/update tank ventilation studies	Challenge assumptions made in previous ventilation system analyses to ensure that tank vent system analyses are consistent with the current System Plan[c] baseline and tank usage scenario. If not consistent, evaluate impacts of changes and update analyses as required.	Revisit and update, as needed, the following: • RPP-11731[w] • RPP-7171[x] • RPP-RPT-49579.[x] Assumptions to be challenged include: • Initial waste temperature increase as a result of deeper sludges present in the DSTs than previously assumed • Maximum allowable DST and DST waste temperature while mixing and feeding waste to WTP • The resulting moisture entrainment and load on condensate collection systems • Mixer pump run times required to mobilize cohesive sludges.
Update IWFD system description	HNF-1939,[x] Volume III was based on Phase 1 feed delivery only and many placeholders for data to be determined.	HNF-1939,[x] Volume III was replaced by RPP-47172[aa] (issued in December 2010).
Update technical baseline summary description	Support update of WFD technical baseline to reflect current technical assumptions and plans.	Update HNF-1901.[bb]

Table D-1. Proposed Strategies Supporting Technical Baseline (6 pages)

Study	Purpose	Scope
LAW feed delivery optimization	Support implementation of best value alternative to mitigate WTP M3 mixing issue.	Review 24590-WTP-RPT-PET-10-005[cc] and provide optimized recommendation (10-TPD-067[dd]).

[a] 24590-WTP-ICD-MG-01-019, 2008, *ICD 19 – Interface Control Document for Waste Feed*, Rev. 4, Bechtel National, Inc., Richland, Washington.

[b] Malen, J., 2002, "Staff Issue Report: Waste Feed Delivery Transfer System, Hanford Site," (Memorandum 02-2045 to J. K. Fortenberry, Technical Director, August 1), Defense Nuclear Facilities Safety Board, Washington, D.C.

[c] ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U. S. Department of Energy, Office of River Protection, Richland, Washington.

[d] HNF-1939, 1999, *Waste Feed Delivery Technical Basis, Volume II, Waste Feed Delivery Flowsheet for Tank 241-AN-104*, Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

[e] RPP-8218, 2001, *Generalized Feed Delivery Descriptions and Tank Specific Flowsheets*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

[f] RPP-40149-VOL1, 2012, *Integrated Waste Feed Delivery Plan, Volume 1—Process Strategy*, and RPP-40149-VOL2, 2012, *Integrated Waste Feed Delivery Plan, Volume 2—Campaign Plans*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

[g] HNF-5177, 2000, *The Settling and Compaction of Nuclear Waste Slurries*, Rev. 0A, Fluor Federal Services, Richland, Washington.

[h] RPP-6548, 2001, *Test Report, 241-AZ-101 Mixer Pump Test*., Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

[i] RPP-11622, 2002, *Double-Shell Tank System Process Control Strategies*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

[j] HNF-2937, 1999, *Estimated Maximum Concentration of Radionuclides and Chemical Analytes in Phase 1 and Phase 2 Transfers*, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

[k] HNF-2004, 1999, *Estimated Dose to In-Tank Equipment and Ground-Level Transfer Equipment During Privatization*, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.

[l] TFC-ENG-STD-34, 2011, *Standard for the Selection of Non-Metallic Materials in Contact with Tank Waste*, Rev. A, Washington River Protection Solutions, LLC, Richland, Washington.

[m] RPP-5346, 2002, *Waste Feed Delivery Transfer System Analysis*, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

[n] HNF-4162, 2011, *Double-Shell Tank Transfer Pump Subsystem Specification*, Rev. 5, Washington River Protection Solutions, LLC, Richland, Washington.

[o] HNF-4163, 2011, *Double-Shell Tank Diluent and Flush Subsystem Specification*, Rev. 6, Washington River Protection Solutions, LLC, Richland, Washington.

[p] RPP-SPEC-47615, 2011, *Double-Shell Tank Process Waste Sampling Subsystem Specification*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

[q] HNF-SD-WM-TRD-007, 2010, *System Specification for the Double-Shell Tank System*, Rev. 5, Washington River Protection Solutions, LLC, Richland, Washington.

[r] HNF-4155, 2011, *Double-Shell Tank Monitor and Control Subsystem Specification*, Rev. 4, Washington River Protection Solutions, LLC, Richland, Washington.

[s] HNF-4157, 2011, *Double-Shell Tank Utilities Subsystem Specification*, Rev. 4, Washington River Protection Solutions, LLC, Richland, Washington.

[t] HNF-4160, 2011, *Double-Shell Tank Transfer Valving Subsystem Specification*, Rev. 5, Washington River Protection Solutions, LLC, Richland, Washington.

[u] HNF-4161, 2011, *Double-Shell Tank Transfer Piping Subsystem Specification*, Rev. 5, Washington River Protection Solutions, LLC, Richland, Washington.

[v] HNF-4164, 2011, *Double-Shell Tank Mixer Pump Subsystem Specification*, Rev. 4, Washington River Protection Solutions, LLC, Richland, Washington.

[w] RPP-11731, 2008, *Thermal Hydraulic Evaluation for 241-AW Tank Farm Primary Ventilation System*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

Notes to Table D-1 continued:

[x] RPP-7171, 2007, *Thermal Hydraulic Evaluation for 241-AN Tank Farm Primary Ventilation System*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

[y] RPP-RPT-49579, 2011, *Thermal Hydraulic Evaluation for 241-AY and 241-AZ Tank Farm Primary Ventilation System*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

[z] HNF-1939, 2010, *Waste Feed Delivery Technical Basis, Volume III, Waste Feed Delivery System Description*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

[aa] RPP-47172, 2010, *Waste Feed Delivery System Description*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

[bb] HNF-1901, 2000, *Technical Baseline Summary Description for the Tank Farm Contractor*, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

[cc] 24590-WTP-RPT-PET-10-005, 2010, *Feed Receipt Vessel Mixing Design Best Value Study – Tank Farms Transfers*, Rev. 0, Bechtel National, Inc., Richland, Washington.

[dd] Bechtol, S. E., "Contract No. DE-AC27-08RV14800 – The U.S. Department of Energy, Office of River Protection (ORP) Direction for Washington River Protection Solutions, LLC (WRPS) to Implement Waste Treatment and Immobilization Plant Project (WTP) Feed Receipt Vessel Mixing Design Best Value Study – Tank Farms Transfers Recommendation," (Letter 10-TPD-067/1001528 to A. B. Dunning, Contracts Manager, Washington River Protection Solutions, LLC, July 1), U.S. Department of Energy, Office of River Protection, Richland, Washington.

DNFSB = Defense Nuclear Facilities Safety Board.
DST = double-shell tank.
IWFD = integrated waste feed delivery.
LAW = low-activity waste.
SST = single-shell tank.
TOC = Tank Operations Contract.
WFD = waste feed delivery.
WTP = Waste Treatment and Immobilization Plant.

Table D-2. Strategies Supporting Operations and Maintenance Planning (2 pages)

Study	Purpose	Scope
Update reliability, availability, and maintainability evaluation	Reliability, availability, and maintainability evaluations can be used to identify spare equipment requirements and potentially influence the process control strategy. For example, HNF-2863[a] indicated that WFD operation with a second source of qualified waste feed in an alternate tank produces a significant decrease in schedule risk. The purpose of this study is to update the reliability, availability, and maintainability analysis to reflect the IWFD system configuration that is consistent with System Plan (Rev. 6)[b] and reevaluate the system.	Revise or replace HNF-2863:[a] • Update database for equipment failure rates. • Update equipment configuration basis consistent with RPP-8218[c] update. • Include sampling, sample transport, and laboratory analysis systems.
Develop preliminary hydrogen control strategy	Develop guidance for setting alarms and monitoring levels for waste flow (pressure, density, and temperature) that are outputs of required instrumentation. There is currently no definitive guidance of waste density or density control as measured by the density/temperature instrumentation in the valving system (HNF-4155,[d] Appendix C). Over the past 10 years, the Tank Operations Contractor has performed numerous waste retrieval and transfer operations, including saltwell pumping, SST waste retrieval to DST, and DST-to-DST transfers, and remediated a Group A tank, SY-101. The technical basis developed by Pacific Northwest National Laboratory and the Tank Operations Contractor has been implemented to control flammable gas hazards for storage and for waste-disturbing operations for over a decade.	Prepare process control plan: • Establish analysis requirements on waste verification samples (particle-size distribution, viscosity, etc.) that would govern transfer settings and flush for each WFD iteration. Include parameters for potential crystallization/precipitation. See RPP-5346[e] summary (assumes no crystallization/precipitation during transfer). • Review hydrogen releases observed at SRS during similar waste feed preparation activities for potential insight into proposed Hanford control (Note: An SRS video shows hydrogen release that starts in a local area and propagates throughout the tank.) • Prepare preliminary process control plan section, with emphasis on flammable gas release controls, showing integration of the control strategy with the monitoring and control system and safety classification of ventilation systems for review with Defense Nuclear Facilities Safety Board staff.

Table D-2. Strategies Supporting Operations and Maintenance Planning (2 pages)

Study	Purpose	Scope
Update WFD O&M concept	Describes how WFD physical system will be operated and maintained, provides traceable basis for allocation of O&M resources.	Develop IWFD operations research model and use model to evaluate necessary strategies to ensure WTP waste feed is provided as required to meet milestones per RPP-RPT-50742.[f]

[a] HNF-2863, 2001, *Waste Feed Delivery System Phase 1 Preliminary RAM Analysis*, Rev. 2A, COGEMA Engineering Corporation, Richland, Washington.

[b] ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U. S. Department of Energy, Office of River Protection, Richland, Washington.

[c] RPP-8218, 2001, *Generalized Feed Delivery Descriptions and Tank Specific Flowsheets*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

[d] HNF-4155, 2011, *Double-Shell Tank Monitor and Control Subsystem Specification*, Rev. 4, Washington River Protection Solutions, LLC, Richland, Washington.

[e] RPP-5346, 2002, *Waste Feed Delivery Transfer System Analysis*, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

[f] RPP-RPT-50742, 2011, *Phase 3 Waste Feed Delivery Operations Research Model Initial Assessment Report*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

DST = double-shell tank.
IWFD = integrated waste feed delivery.
O&M = operations and maintenance.
SRS = Savannah River Site.
SST = single-shell tank.
WFD = waste feed delivery.
WTP = Waste Treatment and Immobilization Plant.

APPENDIX E

INITIAL RISK LIST AND DEVELOPMENT DETAILS

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DEFINITIONS

Definitions are from TFC-PLN-39, *Risk and Opportunity Management Plan*.

Consequence	The estimated impact that a risk or opportunity will incur on a project or activity in terms of project cost or schedule.
Critical risks and opportunities	Most serious risks and opportunities. If a critical risk actually occurs, it could seriously jeopardize or cause project(s) to fail. If a critical opportunity actually occurs, it could significantly decrease project schedule and cost.
Handling strategy	Step-by-step approach to (1) eliminating or reducing the risk if no avoidance strategy is immediately available, or (2) improving the probability or consequence of an opportunity. It includes the date for completion.
Identification	Ongoing, continual process in which all project team members identify and communicate risk and opportunity (R&O) factors that are likely to impact project objectives, such as workscope, quality, schedule, safety, and cost.
Opportunity	A potential event such that if it occurs would have desirable effects on workscope activities in the form of schedule decrease, cost decrease, or redefinition of the technical basis (i.e., a "risk" with a positive benefit).
Residual risk	The risk remaining after successful completion of risk mitigation actions.
Risk	A potential event such that if it occurs would have undesirable effects on workscope activities in the form of schedule delay, cost increase, or redefinition of the technical basis.
Risk management	The organized process that balances costs and risks of an activity or project to maximize success.

RISK ASSESSMENT IMPLEMENTATION

The risk management plan assessment implementation, based on TFC-PRJ-PC-C-13, *Risk Management*, included the following steps.

- Review RPP-40149, *Integrated Waste Feed Delivery Plan* (IWFDP, Rev. 1A), and discuss the current plan with IWFDP team members
- Prepare preliminary R&O list. The preliminary list was obtained from RPP-40149 (Rev. 1A)

- Prepare R&O assessment. An integrated project team (IPT) was convened to (1) review the preliminary R&O list, (2) add to or delete items from the R&O list, and (3) assign probability and consequence levels, assuming no risk-handling strategies, using Table E-1 and Table E-2, respectively. Probabilities and consequences were considered for the waste feed delivery (WFD) program.

  IPT members include:

  - Wes Bryan
  - Scotty Curl
  - Doug Larson
  - Bill Root
  - Bill Peiffer
  - Mike Gray
  - Mike Leonard
  - Jerry Osborne
  - Margaret Perchetti
  - Brian Thompson
  - Jeremy Whitcomb.

Table E-1. Guidelines for Assigning Probabilities

Probability	Threshold definition
Very low	Very low probability ever to occur during the life-cycle of the project. The probability of a specific result of an activity is ≤10%.
Low	Low probability to occur during the life-cycle of the project. The probability of a specific result of an activity is 10% < P ≤ 25%.
Medium	Medium probability to occur sometime during the life-cycle of the project. The probability of a specific result of an activity is 25% < P ≤ 75%.
High	High probability to occur sometime during the life-cycle of the project. The probability of a specific result of an activity is 75% < P ≤ 90%.
Very high	Very high probability to occur sometime during the life-cycle of the project. The probability of a specific result of an activity is >90%.

Table E-2. Guidelines for Assigning Risk and Opportunity Consequences

Consequence	Threshold definition
Very low	Small, acceptable change in project or facility performance; risk is minor threat to facility mission; opportunity would result in minor benefit; possibly requires minor facility operations or maintenance changes without redesign. Cost change threshold: <$15 million. Schedule change threshold: <1 month on a noncritical path item. Technical or other: Design feature must be changed due to small degradation from baseline performance or interface problem.
Low	Small change in project or facility performance; risk is small threat to facility mission; opportunity could result in small benefit; possibly requires minor facility redesign or repair, significant environmental remediation. Cost change threshold: $15 million to $40 million. Schedule change threshold: 1-3 months on a noncritical path item. Technical or other: Redesign of noncritical path item or increased potential for regulatory intervention.
Medium	Medium change in facility performance; risk is serious threat to facility mission; opportunity could result in medium benefit; possible completion of only portions of the mission or requires major facility redesign or rebuilding, extensive environmental remediation. Cost change threshold: $40 million to $100 million. Schedule change threshold: 3-6 months on a noncritical path item; any amount on a critical path item. Technical or other: Threat to mission, environment, or people that requires some redesign, repair, or significant additional environmental remediation.
High	Substantial change in facility performance; risk is critical threat to facility mission; opportunity could result in substantial benefit; risk may cause loss of mission, long-term environmental abandonment. Cost change threshold: $100 million to $200 million. Schedule change threshold: 6-12 months on a critical path item. Technical or other: A major project goal will not be met, or an outside regulator shuts down the job for an indefinite period.
Very high	Very substantial change in facility performance; catastrophic threat to facility mission; opportunity could result in great benefit; risk may result in loss of mission, long-term environmental abandonment. Cost change threshold: >$200 million. Schedule change threshold: >12 months on total project completion. Technical or other: Project cannot be completed.

- Evaluate R&O impact risk values. R&O risk values were developed using Table E-3 based on the probability and consequence levels assigned in the R&O assessment.

Table E-3. Risk and Opportunity Risk Value Determination

Probability of Occurrence						
	Very High	High	High	High	Very High	Very High
	High	Medium	High	High	Very High	Very High
	Medium	Medium	Medium	High	High	Very High
	Low	Low	Medium	Medium	High	High
	Very Low	Low	Low	Medium	Medium	High
		Very Low	Low	Medium	High	Very High
		Consequence of Occurrence				

Table E-4 summarizes the final R&O by activity category, with the probability and consequence scores provided by the IPT. The risk framework was kept the same as in the previous year. Gaps in the risk number sequences indicate R&Os that were removed in the 2011 assessment compared to the 2010 assessment. There were a total of 68 risks and five opportunities in 2011.

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
Overall: Strategy (S)						
S-1	Project plan is assumed to be valid during IWFD projects implementation and DST WTP operations	Project plan is not stable	Project planning revisions will be needed	M	M	H
S-2	Workforce is assumed to be adequate in terms of personnel knowledge and number	Skill mix and labor shortfalls from normal turnover and retirement	Require extensive subcontracting	H	M	H
S-3	Workforce conditions are stable	Work stoppage, resources not available	Engineering, fabrication and construction delays	M	M	H
S-4	HTWOS modeling leads to accurate mission decision	HTWOS modeling leads to inaccurate mission decision	Project delays and increased cost	VL	H	M
S-5	Separate contractors for DST operations and WTP construction	DST-WTP interface communication is not successful	Interrupted WFD during startup and commission	M	H	H
S-6	IWFD system schedule is appropriate to support WTP startup	WFD-DST activities fall behind schedule	WTP operations are delayed	VL	H	M
S-7	WTP commissioning in 2018	WTP commissioning delayed beyond 2018	Require baseline, delay procurements, slowdown strategies	H	L	H
S-8	WTP commissioning in 2018	WTP commission before 2018	Increased cost impact.	VL	H	M
S-9	DST space is managed to address WTP feed requirements	DST space management is inadequate for WFD	Revise DST and WFD space management Increased cost and schedule impact	VL	M	M
S-10	Resolve BDGRE issues to support waste feed delivery	Waste Group A tank management strategy not changed	Strategy needs revision Increased cost and schedule impact	M	L	M

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
S-11	DST-DST transfers support scheduled WFD	Transfers delay WFD	Increased cost and schedule impact	L	M	M
S-12	DST mixing supports scheduled WFD	Mixing delays WFD	Increased cost and schedule impact	M	M	H
S-14	Construct DST retrieval systems on a tank-by-tank basis, with the first system in a farm providing common infrastructure for all remaining systems to be installed in that farm	Have to install multiple infrastructure modifications	Project delays and increased cost	VL	M	M
S-15	To extent possible, construction sequencing will be planned to optimize availability of "outages" as defined in HTWOS	Construction activities occur outside "outages" defined by HTWOS	Project activities are delayed and costs are increased	L	M	M
S-16	Retrieval system and life extension upgrades will be integrated such that common work in same locality will occur at the same time	Retrieval system and life extension upgrades have schedule conflicts	Project activities are delayed and costs are increased	VL	L	L
S-17	Completed retrieval systems will be turned over as a whole, as opposed to partial turnover	Retrieval system is turned over in parts	Increased cost impact	M	L	M
S-18	Deleted					
S-19	A few tanks are outfitted for feeding WTP and less stringent requirements on other tanks	All DSTs need to be capable to feed WTP	Increased cost and schedule impacts	VL	H	M
S-20	WFD is not required to perform ORR	WFD startup is linked with WTP ORR, requiring formal integrated ORR	Increased cost and schedule impacts	L	H	H

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
S-21	IWFD upgrades and schedule life-cycle meets System Plan (Rev. 6)[a] assumptions	WTP operational delays/extends WFD life-cycle	Increased cost and schedule impacts	M	H	H
S-23	Current project planning technology and equipment will meet needs of IWFD system through life-cycle	Extended schedule will require replacement of outdated technologies and equipment	Increased cost and schedule impacts	H	L	H
S-25	ORP strategy on WTP operations is stable	ORP strategy on WTP operations is not stable due to continuing design changes or required changes identified during commissioning operations	Increased cost and schedule impacts	H	VH	VH
S-26	Assumed that underground ventilation is satisfactory Recently upgraded ventilation systems are generally satisfactory to meet requirements Minimal impact to ongoing upgrade projects in the farms.	Tank farms ventilation system upgrades required as a result of safety-significant criteria[b] would incur additional cost and drive schedule delays, potentially impacting in-tank mixer testing and initiation of feed transfer to WTP	Increased cost and schedule impacts	H	M	H
Overall: Budget (B)						
B-1	Funding will support WFD	Funding shortfalls	Increased schedule impact	L	H	H
B-2	Current cost estimates are correct	Estimate uncertainty, validity of assumptions, budget impacts	Likely increased cost or schedule impact	L	M	M
B-3	Funding supports long-lead procurements	Funding is insufficient to procure upgrade hardware per SMP	Procurement is delayed, with impact on WFD Increased cost and schedule impacts	M	L	M
B-4	Funding supports ventilation safety significant upgrades	Funding shortfalls for ventilation system safety significant upgrades	Increased cost and schedule impacts	L	H	H

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
Overall: Stakeholder Requirements (SR)						
SR-4	Tri-Party Agreement,[c] DOE, EPA, and Ecology environmental requirements are stable	Agency and regulatory requirements change	Cost and schedule increase	L	M	M
SR-5	Part B revisions will support schedule	Part B revisions become critical path	Cost and schedule increase	VL	M	M
SR-6	Transfer lines not currently covered by RCRA variance will be upgraded prior to use	Transfer lines not currently covered by RCRA variance are not upgraded prior to need	Increased cost and schedule impacts	VL	M	M
SR-7	No new DNFSB or other outside stakeholder issues	Agency and regulatory requirements change	Cost and schedule increase	M	H	H
SR-8	No new ORP equipment/instrument safety-significant direction issues	Safety-significant requirements changed by the agency and/or regulatory requirements for new equipment or instruments being permanently installed.[d]	Cost and schedule increase	M	H	H
Overall: Certification Requirements (CR)						
CR-1	WTP acceptance criteria are known	WTP acceptance criteria not complete	May lead to cost and schedule increase	M	M	H
CR-2	Rheological properties are known and acceptable	Rheological properties outside WTP criteria	WTP has handling problems, so WFD has cost and schedule increase Potential new tank farms treatment required	M	M	H
CR-3	DQOs are achievable	DQOs are not achievable (e.g., TOC baseline capabilities not with WTP RDQO requirements)	Increased cost and schedule impacts	H	M	H
CR-4	Mixer pump technology is matured to support WFD	Technology maturation is delayed	Increased cost and schedule impacts	L	M	M
CR-5	Dual mixer pumps are adequate for all tank configurations	Dual mixer pumps are inadequate to mix across all tanks	Increased cost and schedule impacts	L	VH	H

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
Equipment: Infrastructure (EI)						
EI-1	Infrastructure upgrades are not impacted	Infrastructure upgrades are impacted	Increased cost and schedule impacts	M	L	M
EI-2	Adequate construction equipment availability to meet WFD DST infrastructure upgrade schedule	Construction equipment is not sufficient to maintain WFD DST infrastructure upgrade schedule	Increased cost and schedule impacts	M	L	M
EI-3	Sufficient electrical capacity for WFD multiple mixer pump operations is available	Insufficient electrical capacity for WFD multiple mixer pump and ventilation system operations	Increased cost and schedule impacts	M	M	H
Equipment: Removal (ER)						
ER-1	Use standard practices No special equipment required	New equipment and procedures are needed to remove tank equipment	Increased cost and schedule impacts	VL	M	M
ER-2	Adequate construction equipment available to meet IWFD projects removal schedule	Construction equipment is not sufficient to maintain IWFD projects removal schedule	Increased cost and schedule impacts	M	L	M
ER-3	Tank farms infrastructure is not damaged during removal	Tank farms infrastructure is damaged during equipment removal	Increased cost and schedule impacts	L	L	M
ER-4	Tanks are not damaged during equipment removal	Tanks are damaged during equipment removal	Increased cost and schedule impacts	VL	H	M
ER-5	Unexpected conditions do not impact operations	Unexpected conditions do impact operations	Increased cost and schedule impacts	M	L	M
Equipment: Installation (EIN)						
EIN-1	Adequate construction equipment available to meet IWFD projects installation schedule	Construction equipment is not sufficient to maintain IWFD projects installation schedule	Increased cost and schedule impacts	L	L	M
EIN-4	LAW tank mixing without saltcake is sufficient with recirculating transfer pump	LAW processing requires mixer pump instead of recirculating transfer pump	Increased cost and schedule impacts	VL	L	L

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
EIN-5	Tank farms criteria can be met by commercial equipment suppliers	Requirements are too stringent, eliminating commercial equipment supply (e.g., safety-significant ventilation system components	Increased cost and schedule impacts	M	M	H
EIN-6	Tank farms existing equipment not damaged during equipment installation	Tank farms existing equipment is damaged during equipment installation	Increased cost and schedule impacts	VL	L	L
EIN-7	Tanks are not damaged during equipment installation	Tanks are damaged during equipment installation	Increased cost and schedule impacts	VL	H	M
EIN-9	Transfer piping in the AN & AW Farms will be re-rated to 400 lb/in^2	Transfer piping in the AN & AW Farms is not re-rated to 400 lb/in^2	Increased cost and schedule impacts	M	M	H
EIN-11	No unexpected hazardous materials will be found during tank farms upgrades	Finding unknown hazardous material during tank farms upgrades	Recovery efforts would have cost and schedule impact	VL	M	M
EIN-12	Unexpected conditions do not impact operations	Unexpected conditions do impact operations	Increased cost and schedule impacts	L	M	M
EIN-13	Only one mixer pump for saltcake dissolution	Saltcake dissolution requires two mixer pumps	Increased cost and schedule impacts	VL	M	M
Operations: General (OG)						
OG-1	DSA modifications support WFD schedule	DSA completion schedule is delayed	Increased cost and schedule impacts	L	M	M
OG-2	TOC transition to WTP operation does not impact WFD	Delay in WFD commissioning and initial operations	Increased cost and schedule impacts	L	M	M
OG-3	Proactive preventative maintenance program maintains operations	Aging equipment decreases feed delivery	Increased cost and schedule impacts	L	M	M
OG-4	Critical replacement equipment is available when needed	Critical replacement equipment not available when needed	Increased cost and schedule impacts	M	M	H

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
OG-6	Normal tank farms operations do not impact IWFD systems	Failure of tank farms systems delays IWFD systems	Increased cost and schedule impacts	L	M	M
OG-7	Transfer and mixer pumps remain cool while operating in deep sludge	Transfer and mixer pumps burnout while operating in deep sludge	Increased cost and schedule impacts	VH	M	H
Operations: DST Mixing (ODM)						
ODM-1	Deleted					
ODM-2	In-tank equipment (e.g., corrosion probes) can withstand mixer pump jet forces	In-tank equipment (e.g., corrosion probes) will break during mixer pump operation, including incremental lowering	Increased cost and schedule impacts	VH	H	VH
ODM-3	400 hp (electric) 305 hp (brake) mixer pumps are adequate	400 hp (electric) 305 hp (brake) mixer pumps are not adequate	Increased cost and schedule impacts	M	M	H
Operations: DST Retrieval/Transfer (ODR)						
ODR-1	Level instrumentation is matured to support material balance	New level instrumentation needs to be developed to monitor real-time surface level	Increased cost and schedule impacts	M	VL	M
ODR-2	DST farms are assumed to support simultaneously: operations of four mixer pumps per farm and one transfer pump per farm	Need more functionality to support the mission (e.g., electrical, HVAC, sampling evolution, transfer lines)	Increased cost and schedule impacts	VL	H	M
ODR-3	Transfer lines do not plug	Sludge transfers require significant modifications to reduce plugging	Increased cost and schedule impacts	VL	H	M
ODR-4	Variable suction depth (200 in. deep sludge) transfer pump operates adequately	Variable suction depth pump (200 in. deep sludge) does not operate adequately	Increased cost and schedule impacts	VL	M	M

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
ODR-5	Ventilation systems replacement in AW and AN Farms are not adequate to support four mixer pumps operating simultaneously in each of the farms (see ODR-2), and may not be able to be upgraded to safety significant	Ventilation systems in DST farms are not adequate to support four mixer pumps operating simultaneously in each of the farms (see ODR-2)	Increased cost and mission schedule	H	H	VH
ODR-6	Although some level of erosion is expected, the degree of erosion will be known, and impact on the floors and walls of the DSTs will be minimal.	The operations of mixer pumps in the DSTs as the sole means for mixing/blending the sludge and supernate for WFD to the WTP may have a detrimental effect to the tank floors and walls as a result of erosion.	Increased cost and schedule impacts	M	H	H
Operations: Staging DST Mixing*						
Operations: Staging DST Sampling (OSS)						
OSS-1	Sampling method is known and available	Sampling actual feed stream not available for WFD	Increased cost and schedule impacts	H	H	VH
OSS-2	Sufficient lab capabilities are available when needed	Inadequate laboratory availability	Scope cost and schedule	M	H	H
Operations: Post-Commission Retrieval*						
Decommissioning and Demolition (DD)						
DD-1	Decommissioning planning is adequate	Decommissioning planning is not adequate	Increased cost	VL	VH	H
Opportunities (OPP)						
OPP-1	Current DST upgrade schedule	Flatten DST upgrade schedule	Shorter schedule and decreased cost	N/A	N/A	N/A
OPP-5	Additional efficiencies cannot be realized	Workscope projecti-zation, streamlining, resource management, consolidation, and energy efficiency	Shorter schedule and decreased cost	N/A	N/A	N/A

Table E-4. Project Plan Strategy Risks and Opportunities (9 pages)

No.	Assumption(s) or need(s)	Risk	Consequence	Scores: Pre-Risk Mitigation		
				Probability	Conse-quence	Risk value
OPP-6	HAMTC craft provisions not realigned	HAMTC craft realignment provision	Shorter schedule and decreased cost	N/A	N/A	N/A
OPP-7	Deleted					
OPP-8	Deleted					
OPP-9	Purchase four mixer pumps per DST farm	Mixer pumps can be reused in other tanks	Reduce cost	N/A	N/A	N/A

[a] ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U. S. Department of Energy, Office of River Protection, Richland, Washington.

[b] Section 5.3.7 provides further detail on safety-significant direction per ORP correspondence 11-AMD-054 (Dowell, J. A., and Bechtol, S. E., 2011, “Contract Number DE-AC27-08RV14800 – Transmittal of Contract Modification 094 and Request for Proposal to Upgrade the Double-Shell Tank Primary Ventilation Systems to Safety-Significant,” [Letter 11-AMD-054/1101124 to C. G. Spencer, Washington River Protection Solutions, LLC, March 1], U.S. Department of Energy, Office of River Protection, Richland, Washington)

[c] Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order – Tri Party Agreement*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

[d] Charboneau, S. L., 2012, “Contract No. DE-AC27-08RV14800 – Designation of New Installed Equipment Used to Support Technical Safety Requirements (TSR) as Safety-Significant (SS),” (Letter 12-NSD-0009/1200026 to C. G. Spencer, Washington River Protection Solutions, LLC, January 23), U.S. Department of Energy, Office of River Protection, Richland, Washington, and Bechtol, S. E., and Dowell, J. A., 2011, “Designation of Installed Equipment Used to Support Technical Safety Requirements as Safety-Significant – Request for Proposal,” (Letter 11-NSD-023/1101145 to C. G. Spencer, Washington River Protection Solutions, LLC, March 11), U.S. Department of Energy, Office of River Protection, Richland, Washington.

B = budget.
BDGRE = buoyant-displacement gas release event.
CR = certification requirement.
DD = decommissioning and demolition.
DNFSB = Defense Nuclear Facilities Safety Board.
DOE = U.S. Department of Energy.
DQO = data quality objective.
DSA = documented safety analysis.
DST = double-shell tank.
EI = equipment infrastructure.
EIN = equipment installation.
EPA = U.S. Environmental Protection Agency.
ER = equipment removal.
H = high.
HAMTC = Hanford Atomic Metal Trades Council.
HTWOS = Hanford tank waste operations simulator.
HVAC = heating, ventilation, and air conditioning.
IWFD = integrated waste feed delivery.
L = low.
LAW = low-activity waste.
M = medium.
N/A = not applicable.
ODM = operations DST mixing.
ODR = operations DST retrieval/transfer.
OG = operations general.
OPP = opportunities.
ORP = U.S. Department of Energy, Office of River Protection.
ORR = operational readiness readiness.
OSS = operations staging DST sampling.
RCRA = Resource Conservation and Recovery Act.
RDQO = regulatory data quality objective.
S = strategy.
SMP = submersible mixer pump.
SR = stakeholder requirements.
TOC = Tank Operations Contract.
VL = very low.
VH = very high.
WFD = waste feed delivery.
WTP = Waste Treatment and Immobilization Plant.

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